THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

VOL. IX.—No. 210.

THE PARIS ELECTRICAL EXHIBITION.

THE BRITISH SECTION.

THE INDIA-RUBBER, GUTTA-PERCHA AND TELEGRAPH WORKS COMPANY.

THE exhibits of this Company are comprehensive, and consist of a varied assortment of electrical instruments and other objects of interest contributed by the different departments of the Silvertown works; the exhibits of the branch works at Persan-Beaumont, near Paris, are included in the French section.

CABLE DEPARTMENT.

A specimen case contains samples of "deep sea," "intermediate," and "shore end" cables manufactured at the Silvertown works. The total length of telegraphic and torpedo cable made since 1866, amounts to 11931 knots, exclusive of 3180 knots now in course of construction for the Central and South American Telegraph Company; the weights of these cables vary from 24 cwt. to 27 tons per knot.

The 27-ton cable is the heaviest type hitherto constructed at Silvertown, and forms part of the cable laid last year by this company between Grosse Island and the Bird Rocks, in the Gulf of St. Lawrence. On account of the precipitous nature of the Bird Rocks, where the cable is landed, and the danger of the cable becoming jammed by the ice, an exceptionally heavy type has to be used.

The specimens include telegraphic cables made for the British Government and Colonies, India, France, Russia, Peru, Chili, and Japan; there are also torpedo cables, of single, four, and seven core, as supplied to the British Government and Colonies, the United States, Spanish, Dutch, Chinese, and Argentine Governments. Samples of gutta-percha and india-rubber covered wires, of the description which the I. R. G. P. Co. supplies to the British Post-office, the French, and other Governments, for their under-ground systems, are also shown. The form of underground lines adopted in France differs from that of the Post-office in being almost exclusively inclosed in leaden pipes.

"BROOKS' UNDERGROUND MULTIPLE CABLE" system, which has been in successful operation for some years in the United States, and has also been tried by the Post-office with very satisfactory results, has been fully described in the numbers of the Journal for December 1st, 1879, and August 15th, 1881.

A short experimental line of 500 ft., with 28 conductors inclosed in pipes filled with petroleum—with terminal poles and oil reservoir complete—is to be seen fitted up in the Exhibition, the object being to show practically that the system is peculiarly adapted for avoiding inductive disturbances in telephonic circuits.

INSTRUMENT DEPARTMENT.

Amongst the "GALVANOMETERS" are the following:—"Thomson's reflecting astatic galvanometer," complete with shunts, lamp and scale. The four coils in this instrument admit of being coupled up in five different ways so that their total resistance can be made as follows:—1st, All coils in series; 2nd, $\frac{4}{5}$ the total resistance; 3rd, $\frac{1}{4}$ the total resistance; 4th, $\frac{4}{16}$ the total resistance; 5th, $\frac{1}{16}$ the total resistance, the galvanometer leading wires being in each case connected to the same terminals.

"Thomson's reflecting marine galvanometer," complete with shunts, lamp and scale. "Small reflecting galvanometer," with oil vessel, shunts, lamp and scale (Government pattern). "Portable astatic galvanometer," in brass case, with jewelled centres, having 1,000 ohms resistance, in sling leather case, with controlling magnet. "Tangent galvanometer" (Post-office pattern), for testing with received currents, fitted with resistance coil, shunt and short-circuit key. "Speaking galvanometer," for submarine cable work, with lamp, condensing lens and scale stand. "Signalling key," for mirror speaking instrument (Silvertown pattern).

The "RESISTANCE COILS" shown are:—Large set of "Wheatstone bridge resistance coils" (Dial pattern), arranged in units, tens, hundreds and thousands; with proportional parts of 10, 100, 1,000, and 10,000 ohms. Set of "Wheatstone bridge resistance coils" (Post-office pattern), fitted with battery and galvanometer keys, in polished wood case with lock and key.

There are also exhibited "Speaking instruments," "Morse direct ink writers," a "Morse pony sounder instrument" (Post-office pattern), "Morse single current keys" (Post-office pattern), "Bain's fast-speed receiver," for automatic working, fitted with speed regulator, "Wheatstone's A B C instrument (induced magnets), consisting of indicator, communicator and clockwork bell.

Amongst the "RAILWAY SIGNAL INSTRUMENTS are:—"Walker's patent train describer," receiver and sender. By pulling forward a small lever opposite the name to be sent, and pressing back a similar lever at the name last sent, the "sender" attracts attention at the distant station by a single stroke on a bell, and at the same time indicates the name of the coming train on the "receiver," which is provided with a dial labelled to correspond, and a rotating pointer in the centre. "Walker's direct-action semaphore repeater," showing the three positions of the signal arm." Complete set of "Walker's electro-magnetic telegraph semaphores" for railway block signalling. Complete set of "Preece's single wire block signalling instruments," consisting of semaphore, switch and plunger. "Preece's double current light and

arm repeater." "Single stroke direct action bell," with key.

There are also shown the "Silvertown water-level indicator and contact-maker," for showing the rise and fall of water in reservoirs at the engineer's office, situated away from the reservoir. "Hall's patent anemometer, with telephone receiver," to indicate audibly at a distance the rate of air passing through underground workings in mines. The anemometer is of the ordinary cup form, and at every revolution causes a spring to vibrate in close proximity to the pole of a Bell telephone. The induced currents thus generated in the telephone coil being transmitted to the distant receiving telephone reproduce on it the sound imparted to the spring every time it is set vibrating. The number of these vibrations, or revolutions, in a given time, is an index of the rate at which the current of air passes through the workings.

A case of specimen "carbon rods," varying from 3 to 25 millimetres in diameter, for electric lamps, is also exhibited.

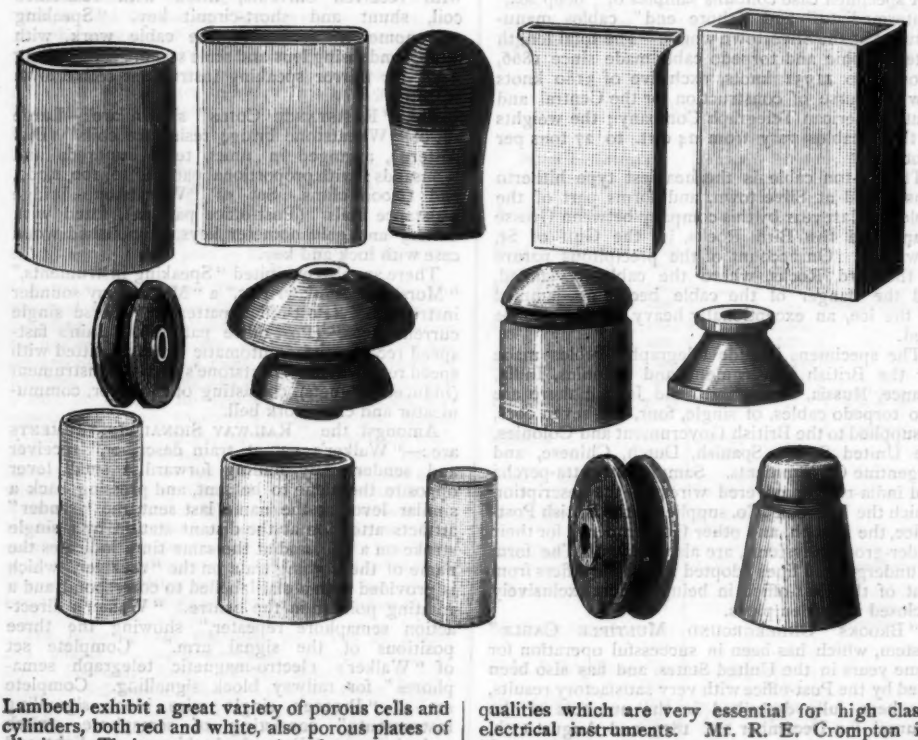
(To be continued.)

JAMES STIFF & SONS.

Messrs. Jas. Stiff & Sons, of London Pottery, Lambeth, exhibit a great variety of porous cells and cylinders, both red and white, also porous plates of all sizes. Their porous ware has for many years possessed a high reputation, and has been extensively used by some of the best electricians and telegraphic engineers.

Vitrified stoneware battery jars and telegraph insulators, of all the most usual shapes and sizes are, also exhibited by this firm. These goods have stood the tests to which they have been submitted in the most satisfactory manner. Models of retorts, receivers, acid pans, condensing coils, and other chemical apparatus, in brown and white stoneware, are also shown. Messrs. Stiff & Sons gained prize medals at Paris, in 1878, and at most of the other international exhibitions.

The illustrations which we give show some of the varieties of battery jars, insulators, etc., which are amongst the exhibits.



PHILLIPS BROS.

Messrs. Phillips Bros., of Mackintosh Lane, Homerton, London, exhibit a number of specimens of silk-covered copper wire for electrical purposes. These specimens are remarkable for the uniformity and closeness with which the coverings are laid on, qualities which are very essential for high class electrical instruments. Mr. R. E. Crompton is Messrs. Phillips' Paris agent.

ROBEY & Co.

The display of steam power by Messrs. Robey & Co., of Lincoln (whose stand adjoins that of the Anglo-American Brush Electric Light Corporation), is very fine. A line of intermediate shafting, placed on columns about 12 feet from the ground, transmits the power from the engines to two long rows of brush dynamo-electric machines.

All the engines are of the well-known patent Robey engine type (*see* TELEGRAPHIC JOURNAL, Feb. 15th, 1879), they are seven in number, varying in size from 10 to 40 horse-power nominal, and capable of giving out an aggregate effective power of about 250 horses.

The 40 horse-power engine is at present driving about 40 arc lights, and after careful experiments, extending over the usual evening run of three hours, it was found that the variation from the nominal speed, did not exceed one revolution during the whole of this time; this result being mainly due to the special combination of automatic governor and equilibrium valve used on these engines when employed for electric lighting.

The first three engines in the line of seven are driving on to one length of shafting, the result being that any variation in one engine is absorbed by the other two, and an almost perfect uniform speed is obtained. Thus, if three engines are running at full speed under their usual load, then by slightly turning a nut on the governor-spindle, the work done by any one engine may be doubled, the result being not to increase the speed of the shafting, but to halve the work done by the other two engines so that the total amount of work done remains the same. If, for instance, the three engines are indicating 10 horse-power each, then, by adjusting the governor of the centre engine until a diagram indicates 20 horse-power, it will be found on applying the indicator to the other engines, that they are indicating only five horse-power each, the total power remaining the same.

There are two great advantages in this arrangement, the first being that any slight variation is immediately absorbed, and amounts, in fact, merely to a tendency to variation; the second being that in the event of an accident to the governor, causing the full boiler pressure to be thrown on to the engine, the speed of the shafting remains constant.

The remaining four Robey engines are each driving an independent shaft, which shaft can be coupled up to form one continuous line of shafting when necessary, friction clutches being used for this purpose; by this means any one of these engines can be used for experiment without interfering with the others. All the engines can be coupled together, and any one of them can be stopped independently of the others. It is worthy of observation that these engines are all running very quietly at a moderate speed, and well within their capabilities.

MR. KILLINGWORTH HEDGES

Exhibits his electric lamp, which has been specially designed to avoid the complications of the ordinary electric lamp where the regulation is effected by clockwork. In this lamp the carbons are so arranged that they are maintained at the proper distance by the action of gravity alone.

The apparatus used in the connection with the electric lighting of the Liverpool Docks is alone shown. The electric light has been used here for contractors' purposes for five years, and, as a proof of the durability of the generating machines, the same plant is now being used for the permanent illumination of the new docks.

The system employed is that of working a single light from each machine. For purposes where a large area is to be illuminated this is certainly the most economical mode of lighting: for not only is there a loss if the current is divided, but to enable the division to be carried out practically, each lamp must be fitted with a self-acting switch and an equivalent resistance to itself which comes into action if the lamp goes out. The generating machine must also be duplicated in order to provide against any accident to the one at work.

FIG. 1.

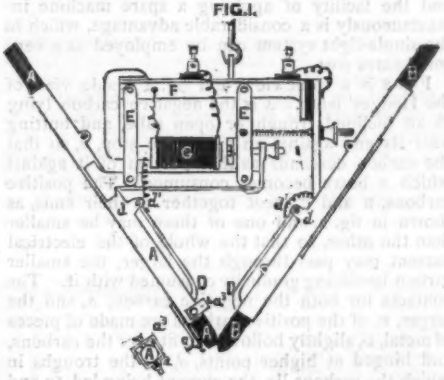
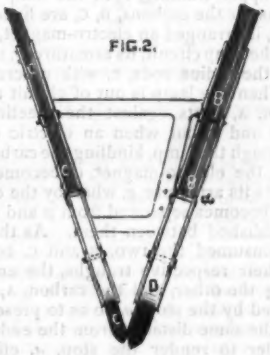


FIG. 2.



The deviator shown by Mr. Hedges provides against an accident to any number of machines working single lights, in the simplest manner. By having one machine running in open circuit, and consequently absorbing only the power required to rotate it, and connecting this to a bar similar to that in an ordinary resistance coil, then by inserting a plug, the spare current can be switched on to either one of the faulty circuits instantaneously.

It is usual to connect either of the circuits to an indicator, which shows a signal and strikes a bell should the current cease, so as to draw the attention of the attendant. Where the electric lighting plant is properly looked after, such a failure is very unusual; however, it is sometimes necessary to stop to adjust the brushes or look to a hot bearing, and the facility of applying a spare machine instantaneously is a considerable advantage, which in the single-light system can be employed at a very small extra cost.

Fig. 1 is a front view, and fig. 2 a side view of the Hedges' lamp. A is the negative carbon lying in an inclined trough or open tube, and butting near its end against an adjustable stop, *a*, so that the carbon descends as that portion of it against which *a* bears becomes consumed. The positive carbons, B and C, meet together at their ends, as shown in fig. 2, and one of these may be smaller than the other, so that the whole of the electrical current may pass through the larger, the smaller carbon becoming gradually consumed with it. The contacts for both the negative carbon, A, and the larger, B, of the positive carbons are made of pieces of metal, D, slightly hollowed to fit over the carbons, and hinged at higher points, *d*, to the troughs in which the carbons lie, the current being led to and from the contact pieces, D, by wires, d^1, escaping the joints of their hinges. The trough in which the carbon, A, lies is suspended by radius rods, E, E, from the upper framing, F, of the lamp to which the troughs for the carbons, B, C, are fixed. In the framing, F, is arranged an electro-magnet, G, having its coil in the lamp circuit, its armature, *g*, is attached to one of the radius rods, E, with a screw adjustment. When the lamp is out of circuit the end of the carbon, A, butts against the meeting of the carbons, B and C, but when an electric current is passed through the lamp, kindling the carbons where they butt, the electro-magnet, G, becomes excited and attracts its armature, *g*, whereby the end of the carbon, A, becomes separated from B and C, and the arc is established between them. As the carbons become consumed the two, B and C, continue to descend their respective troughs, the end of each supporting the other, and the carbon, A, advances, as permitted by the stop, *a*, so as to present its end at nearly the same distance from the ends of B and C. In order to render the stop, *a*, effective, an abutment screw, a^3, is provided at the upper side of the carbon, A.

JAMES FYFE.

Mr. James Fyfe, of 52, Queen Victoria Street, London, exhibits the Pilsen lamp (see *Telegraphic Journal*, December 15th, 1880), and also the Joel incandescence lamp (see *Telegraphic Journal*, November 1st, 1880). The Schuckert dynamo machine (see *Telegraphic Journal*, April 1st, 1879), which is also amongst the apparatus shown, has recently been tested by Mr. Schuckert in Paris with the following results:—

Machine Resistances.	Ohms.	Revolutions per minute.	H.P.	Resistances, Ohms.		Webers.	Volts.	
				External.	Total.		Total.	External.
Ring	5·7	700	5·5	27	40	9	360	243
Magnets	6·6	,,	5·0	30	44	8	351	240
Total Cold ...	12·3	,,	4·5	35	49	7·4	362	259
Warm	14	,,	3·8	40	54	6·5	351	260

At 720 revolutions, 6 Pilsen lamps with arcs 2 to 2·5 mm. wide and 7·5 to 8 Webers of current burn well with 4·5 h.p.

THE BRITISH ASSOCIATION.

ON A NEW SCREW GAUGE FOR ELECTRICAL APPARATUS.

By W. H. PREECE, F.R.S.

(Read before the British Association at York, Sept., 1881.)

IT is very desirable to establish a gauge for the manufacture of various small screws used in the construction of telegraphic and electrical apparatus. Sir Joseph Whitworth, in England, and the Franklin Institute in America, have done this for the bolts and screws used in mill-work and engineering generally, but no one has extended either system to the finer work used in those numerous practical applications of electricity that are now becoming so important. Gauges and screw-plates are now as numerous as the makers engaged in the trade. Nettlefold's sizes of screws are, perhaps, those best known, but they are worked to a special gauge, starting from a diameter of 0·5 inch, which is numbered 32, and which has no known relation to any other gauge used in telegraphy. Whitworth's standard gauge for watch and instrument makers has not yet been adopted. The microscopical gauge is confined entirely to microscopes. There is, in fact, no fixed pitch, no form of thread, no recognised number of threads per inch, no gauge based on practice and experience. Hence inter-changeability for repairs is impossible, and the difficulty of applying for materials from abroad becomes very great. Screws are now generally supplied as "per pattern."

Sir Joseph Whitworth has remedied these defects in the larger forms of machinery, and, at the present moment, there is not a ship in Her Majesty's Navy which is not supplied with the same screws and the same threads. Many large engineering works, such as those at Crewe, are in the same happy condition. Sir

Joseph Whitworth carried his proposed standards for taps and dies to ·100 inch diameter, having 48 threads per inch, but his gauge has not come into general use for sizes less than ·250 inch diameter. I have placed myself in communication with most of the principal electrical apparatus manufacturers in England, and they have not only expressed their willingness to accept a well-conducted gauge, but have concurred in the view I have indicated of the present unsatisfactory condition of the question.

It fortunately happens that, from the point where Sir Joseph Whitworth and the Franklin Institute start in one direction, we can move in the opposite direction, so that, not only can the two gauges be made continuous, but though necessarily different in their applications, they can really be made uniform in their character. Indeed, the Whitworth gauge might itself, with slight modification, be extended.

It is only necessary for us to consider angular threads; square threads do not enter in such small work.

The Whitworth gauge specifies that the pitch of angular threads shall be equal to the depth which involves an angle of 55°, and that the top and bottom shall be rounded off to $\frac{1}{6}$th of the depth.

Screws of a diameter of $\frac{1}{4}$ in. (or No. A in the B.W.G.) have 20 threads to the inch. This is the starting-point of the American gauge, and both deal with increasing diameters. I propose to start from the same point, but to work in the opposite direction, dealing with diminishing diameters. Thus my starting-point is of the new No. 4 centimètre gauge, ·251 in. diameter, having 20 threads to the inch.

The exchange of apparatus between this and continental countries is now so general, that the adoption of the French decimal metrical system is well worth serious consideration. This is felt so much that in nearly every table of wire gauges the dimensions both in parts of inches and metres are given. The adoption of the metre as the unit length would secure adoption of the gauge abroad. The use of the inch as a unit leaves us in that singular insular position to which Sir William Thomson pointedly referred in Section A. the other day.

There are two dimensions besides the form and nomenclature to be considered, viz., the diameter of the screw and the number of threads per unit length. I suggest that the nomenclature be that of the wire gauge. The form I again refer to.

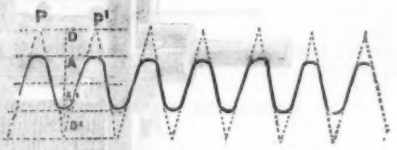
For the first dimension we might adopt a special number, as is done in the trade now, or we may take the same number for the screw and its diameter in *mils* or in millimètres, or, as I propose, we should adopt the new centimètre gauge recommended for adoption by the committee of the Society of Telegraph Engineers (December, 1879).

For the second dimension I propose to take the 5th multiple of the number of the screw in the new centimètre gauge as a factor. Thus No. 5 screw will have 25 threads to the inch, and its diameter will be ·225 in. No. 8 screw will have 40 threads to the inch, and its diameter will be ·161 in., and so on, as shown in the attached table, which embraces nearly all the screws now in use. In all other gauges the number of threads per inch is perfectly arbitrary. In fact, at present, even with the same gauge and the same kind of screw, the number of threads per inch varies.

Thus, if there is any value in my suggestion, we should have a simple nomenclature and a fixed gauge based on that already adopted for wires and plates, and easily remembered.

The attached diagram gives an idea of the character of the thread recommended by me for consideration. It has been carefully prepared with existing threads, and due regard has been paid to the essential requisites of strength, durability, and friction, but in the opinion of some, the depth of the thread is too deep in proportion to the diameter of the screw. In the small screws used for telegraphic and electrical purposes we need not consider the difference of metals employed.

There can be no doubt that a recognised gauge, with a distinctive name, based on a simple method, and



easily remembered, and supplied by such a house as that of Whitworth, will soon take root and be generally accepted, if stamped with the requisite authority.

I submit that the subject be referred to a committee of this section for consideration and examination, so that a new gauge may be recommended for adoption, with all the authority of the British Association.

PROPOSED TELEGRAPH SCREW GAUGE.

Gauge.	Threads per Inch.		Diameter.	
	Whitworth.	Telegraph.	Inches.	Millimètres.
4	20	20	·252	6·4
5	24	25	·225	5·7
6		30	·201	5·1
7	...	35	·180	4·6
8	32	40	·161	4·1
9	...	45	·144	3·7
10	40	50	·129	3·3
12	48	60	·103	2·6
14	...	70	·082	2·1
16	...	80	·066	1·7
18	...	90	·053	1·34
20	...	100	·042	1·07

A NEW DYNAMO-ELECTRIC MACHINE.

WE give an engraving of a new continuous-current dynamo-electric machine, recently perfected by Mr. Clinton M. Ball, of Troy, N.Y. This inventor has been engaged during some years past in building machines similar in type to the alternating current machine of Hefner-Alteneck especially in respect to the absence therein of solid metal parts in the armature, the latter being constituted in the form of a disc composed of a series of coils without iron cores, arranged and adapted to be moved in a magnetic field consisting of a series of poles of alternately opposite polarity on the same side of the disc, and facing opposite sides of the disc.

Mr. Ball has perfected several forms of continuous-current machines of this general type, and from among them we have selected two forms, which we illustrate. These machines have been operated with entire success at Troy; and samples of the machine are either already installed at the Paris Exhibition of Electricity, or are on their way to that destination, forming a part of the joint exhibit made by the "White House Mills" and Mr. Ball.

The bipolar machine, fig. 1, reproduces the effects

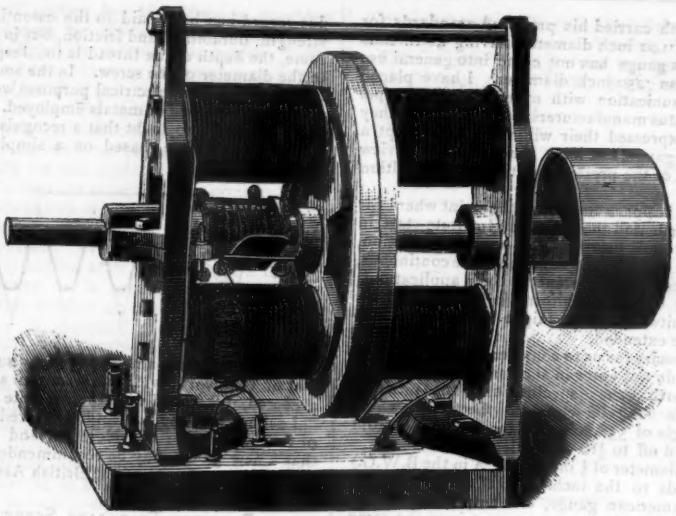


FIG. 1.—BIPOLAR DYNAMO-ELECTRIC MACHINE.

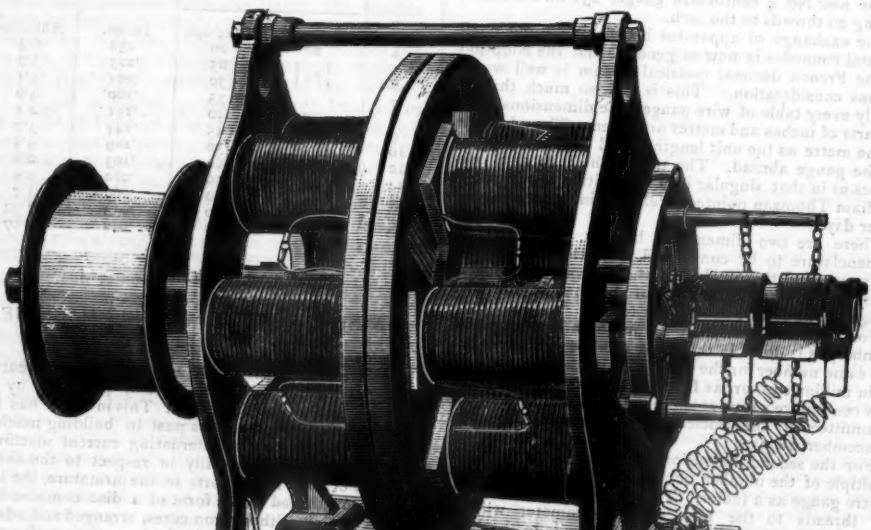


FIG. 2.—COMPOUND MULTIPOLAR CONTINUOUS-CURRENT MACHINE.

of the well-known Gramme machine, over which it possesses important advantages. Its special peculiarities and advantages may be briefly summed up as follows:—The armature is composed of coils, six in number, each of which occupies a sector of the disc of 60°. These coils are made self-supporting in the disc, without iron cores or metallic parts other than the wire of which they are composed, and are connected in a continuous circuit. The commutator plates are six in number, and constitute the terminals of offshoots from the junctions between two contiguous coils. These commutator plates are usually disposed spirally about the axis of the arbor of the machine so as to show at opposite ends an angular displacement from axial parallelism of 30°. From this it results that during rotation a pair of diametrically opposite coils in the armature are bi-circuited during one-twelfth of a revolution at the neutral point of the machine, and this effect recurs successively through the entire series of coils. It will be understood that an important advantage is gained by this arrangement, inasmuch as the resistance of the inactive coils of the armature is thereby eliminated from the internal circuit of the machine. This machine, used as a generator, presents striking and powerful effects with small expenditure of power. It may be used as a very perfect form of an electro-magnet motor. It runs without serious sparking at the commutator, and is simple and compact in construction. A further noticeable feature, which exists furthermore in all machines of this type, is the absence of any noticeable external magnetic field when running.

The other machine, fig. 2, is a compound multipolar continuous-current machine, embodying characteristics of fundamental arrangement which distinguish it from all others; while, as before stated, in some of its theoretical aspects it resembles the machine of Hefner-Alteneck.

The machine represented in the engraving, it will be noticed, has only six opposite pairs of poles in the field system. The continuous-current armature system of the machine has eight elements, and the commutator twenty-four plates. The armature is otherwise composed in two sections or layers, the major section of which is utilised through a commutator or contact rings of ordinary construction for doing work upon the external circuit, while the continuous current section maintains the magnetism of the field.

In this machine, developed and constructed long before the publication of any description of Hefner-Alteneck's machine, the currents are commutated continuously, somewhat as in his machine, the commutator connections being so made that while the contact brushes remain in a fixed position, the currents are brought to them from the consequent electrical poles of the armature—the consequent points, during rotation, assuming successively different positions in relation to the field, and completing the cycle of changes during half of a revolution of the armature. During this time, furthermore, the line bisecting the armature and marking the consequent electrical points, has twice travelled over the complete circuit of the field in advance of rotation. In the case of a machine having more poles in the field than armature elements, the movement of this line would be retrograde; however, if the multiple of half the number of field poles into the number of armature elements remained the same, the number of changes would be the same in either case.

It will be seen that this machine differs from that of Hefner-Alteneck in respect to the proportion of armature elements to the number of poles of the magnetic field—the Ball machine, having a larger number of armature elements than of field poles, while his has a less number. The arrangement selected by Mr. Ball is more favourable to a simplification of details of construction without detriment to the efficiency of the machine.

At a speed of rotation of 9,500 to 1,000 per minute, and with an expenditure of 5½ to 6 horse-power, this machine has proved capable of maintaining a series of ten to twelve arc lights of good power. The machine weighs only 850lbs.—*Scientific American.*

HERZ'S TELEPHONE SYSTEM.

By COMTE TH. DU MONCEL.

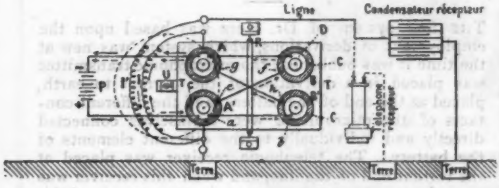
THE first system of Dr. Herz was based upon the employment of derivations, which system was new at the time it was published; the microphonic transmitter was placed in a derivation of the current to earth, placed at the end of the battery, and the different contacts of the microphone were themselves connected directly and individually to the different elements of the battery. The telephonic receiver was placed at the further end of the line, and when this receiver was a condenser, its armatures were, in consequence of this arrangement, polarised in a continuous manner, which enabled speech to be reproduced.

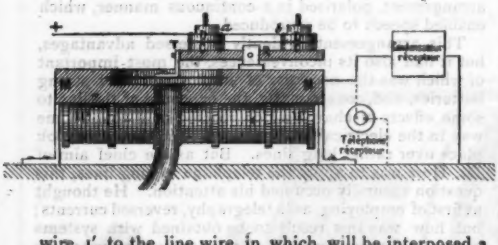
This arrangement evidently possessed advantages, but it had also its inconveniences, the most important of which was the necessity of employing rather strong batteries, and, consequently, the exposure of the line to some effects of charge which reacted in a troublesome way in the electrical transmissions when the latter took place over rather long lines. But as the chief aim of Dr. Herz was to apply the telephone to long lines, this question naturally occupied his attention. He thought at first of employing, as in telegraphy, reversed currents; but how was this result to be obtained with systems based on the employment of transmitters actuated by sonorous vibrations? This could be solved by the employment of secondary currents from induction coils, as has been done by MM. Gray, Edison, &c., but then benefit was only derived from the amplifications furnished by the derivations to the variations of pressure in the microphones; he therefore thought to increase the effects of the induced currents themselves by prolonging their duration, or rather by combining them so as to make them follow two by two in the same direction, and the following is the way in which the problem was solved.

It may be recollected that Dr. Herz had, in his first experiments, proved the efficacy of the microphonic contacts obtained by the superposition of discs of carbon or other semi-conducting substances. He employed them with various entirely different groupings, and in general the horizontal arrangement was found to give the best effects. Let us suppose, then, that four systems of contacts of this kind are arranged at the four corners of a plate of ebonite, C, C, as shown in figs. 1 and 2, by A, A', B, B', and that they are connected together in the manner shown, that is to say, the upper discs, *e*, *g*, *f*, *h*, parallel to the sides of the plate, and the lower discs, A, A', B, B', diagonally. Let us suppose also that the plate can turn round an axis, E, that the discs are traversed by small pins fixed in the plate, and that small discs of lead rest on the upper discs. Finally, let us suppose that the plate is connected at its edge to a telephone diaphragm, by an angle piece, T; it can be at once understood that the vibrations, produced by the diaphragm, will cause the

plate, C, C, to oscillate, and that there will result on the part of the discs two effects, which will follow one another. The first effect will be that produced by the ascending vibrations, and will be an increase of pressure effected between the left-hand discs, and produced by their force of inertia augmented by that of the lead discs; the second effect will be that caused by the right-hand discs, and this will be a diminution in the pressures.

If the current of a battery, P, traverses all these discs, by the connections which we have indicated, and passes through the primary coil (by the wire, 1,) of an induction bobbin, H, H' (fig. 2), placed beneath the apparatus, and if the secondary current of this bobbin passes, by the





wire, 1', to the line wire, in which will be interposed a telephone or a speaking condenser, it follows that at the moment of the ascending vibrations, there will be produced an induced current in the reverse direction to that which will instantaneously succeed it, and which being reversed in consequence of the connections of the discs being crossed, will continue the action of the first current or will augment its duration, and, consequently, its power to actuate the telephonic receiver. The results of this system are very good; though Dr. Herz has tried to simplify it. Several arrangements have been tried. For example, in order to obtain the reversal, a contact has simply been placed on each side of the vibrating plate; although, as is well known, the movements of this plate are not of the same nature as ordinary sonorous movements, it was thought that they might be of the reverse kind on the two sides of the plate, and that one of the contacts would be compressed whilst the other would be expanded. This arrangement, otherwise advantageous, necessitated the plate being placed vertically, so that the same adjustment could be given to the two contacts which ought to be identical. It was difficult to regulate by weights, and even to obtain adjustment it was necessary eventually to employ two parallel diaphragms, vibrating in unison and each carrying a contact, but in opposite ways. The horizontal arrangement was reverted to; but by a convenient combination, the two principles of Dr. Herz, viz., derivation and inversion, are combined. The current is then varied by a double contact where it divides, and this contact is arranged beneath a plate, so that its two points of variable resistance act in a reverse way as regards each other, or only (in some apparatus) so that one of the points has no variation whilst the other acts. It is easy to understand the effect that would be produced. The system has, moreover, been experimented with under various forms; sometimes the derivation is simple, that is to say, only one of the currents is sent to line; sometimes it is double, each of the branches being furnished with a bobbin, and communicating with the receiver. In this case the result is remarkably good, but the apparatus is rather complicated; it requires, amongst other things, great care in construction, experiment having shown that the induction bobbins should not be equal, but that they should have resistances arranged according to the circuit served.

It must be added that the researches are being continued in order to determine which are the proper substances to employ as contacts for the microphones. The number of these bodies which have been tried is very large, and the important result has been arrived at, that the number of substances which can be employed is almost innumerable. The contacts in the Herz apparatus have been made with conducting substances (metal for example) reduced to powder and agglomerated, by chemical means, with a kind of non-conducting cement. The proportion of the combination of the substances depends upon the conductibility of the materials employed, and it alone determines the microphonic value of the composition; the nature of these elements appears to exercise scarcely any influence.

The speaking condenser has not been neglected, if it is useful to obviate the effects of induction. For this purpose experiments have been made to determine a convenient arrangement of the same and a regular mode of construction, the good working of this piece of apparatus being absolutely dependent upon the care with which it is set up.

According to M. Herz, the telephone should not remain an instrument which has variations in form merely; it ought, on the contrary, to be modified according to circumstances. He thinks that a telephone working to a long distance should differ from a telephone for town work only, that an apparatus made to transmit singing should not be the same as one to transmit speech; also that various types should be assigned to various purposes.—*La Lumière Electrique.*

ELECTRICAL EXHIBITION AT THE CRYSTAL PALACE.

THE Lord Mayor presided, on the afternoon of the 24th October, at a meeting at the Mansion House to consider the propriety of holding an Electrical Exhibition at the Crystal Palace similar to that now being held in Paris.

Mr. McGeorge, chairman of the Crystal Palace Company, moved that the following gentlemen, with power to add to their number, be constituted an honorary council of advice:—The Lord Mayor, Mr. J. Abernethy (President Institute Civil Engineers), Professor W. Grylls Adams, Sir James Anderson, Mr. E. J. Ashby, Professor W. E. Ayrton, Lieut. Colonel T. U. Bateman-Champain, Colonel Beaumont, Mr. J. T. Bedford, Sir Henry Cole, Mr. W. Crookes, Mr. S. T. Day, Mr. Alderman Ellis (Lord Mayor Elect), Mr. H. G. Erichsen, Mr. H. C. Ford, Captain Douglas Galton, Dr. Gladstone, Colonel Gourard, Mr. W. Grantham, Mr. C. Gregory, Mr. Alderman and Sheriff Hanson, Sir J. Hawkshaw, Mr. John Holmes, M.P., Dr. J. Hopkinson, Admiral Sir

E. A. Inglefield, Professor Fleeming Jenkin, Mr. P. De Keyser, Mr. Laing, M.P., Mr. Sheriff Ogg, Sir Arthur J. Otway, M.P., Sir E. J. Reed, M.P., Mr. Samuelson, M.P., Colonel Sir Herbert Sandford, Mr. J. S. Sellon, Dr. C. W. Siemens, Mr. W. Spottiswoode (President Royal Society), Sir Henry Tyler, M.P., Mr. C. V. Walker, Mr. T. Waller, Sir E. Watkin, M.P., Mr. Pender, M.P., Mr. Hyde Clarke, and Sir John Bennett.—Mr. McGeorge stated that no guarantee fund would be required, but it was thought that from the great public interest attached to the subject, and the great public advantages likely to accrue, the City companies and the public generally might be appealed to for the purpose of providing gold medals as awards to the exhibitors. The jurors would be composed of gentlemen of the highest possible standing, who had at heart the progress of electricity.

Mr. C. Schiff, one of the Crystal Palace directors, seconded the motion, and it was carried unanimously.

Major Flood Page explained that the directors of the Crystal Palace, being anxious to do all in their power to promote technical education on the lines of the Great Exhibition of 1851, to which the Crystal Palace owes its origin, and having regard to the strong interest excited in the scientific and commercial worlds, and in the mind of the public generally, by the rapid advances recently made in the application of electricity, had decided that the second of the series of international exhibitions, inaugurated in June last by his Royal Highness the Duke of Connaught, should be an Electric Exhibition. With this view, communications had been opened with the leading exhibitors at the Electric Exhibition in Paris, and with others who have made the development of electricity their special study. Although but a very short period had elapsed since the first steps were taken, the responses had been such as to render it certain that an effective and varied display would be made at the Crystal Palace. Most of the best known systems of electric lighting would be represented; and various new lamps would be exhibited for the first time in public. The storage of electricity, would, it was hoped, be illustrated by Faure's and De Meritens' secondary batteries. Telephones, which were not nearly so much used in England as elsewhere, would be strongly represented; and the various applications of electricity as a motive power would be seen in Trouvé's boats and other interesting exhibits. Many eminent scientific men had expressed great interest in the undertaking, and intend to become exhibitors. The directors hoped, with the help of the Honorary Council, to make the forthcoming exhibition valuable to manufacturers, railway and dock companies, and others who are thinking of applying electricity to their various undertakings, and the most interesting of the kind to the general public that has ever taken place in England. It was proposed to open the Exhibition in December next, and that it should continue open for some months. Exhibitors would be received on and after 21st November. Exhibitors would not have to pay any rent, but they would, at their own expense, place and decorate their exhibits. Engine power would be found for those exhibitors of electric light who applied for it, so far as the arrangements would admit. He hoped that the Government would see their way to giving the Exhibition both their countenance and support. It was of great importance that they should do so—(hear, hear).

Mr. J. Holms, M.P., moved—"The Honorary Council having heard a report from the directors of the Crystal Palace with reference to the International Electric Exhibition—being the second of the series of international exhibitions inaugurated in June last by his Royal Highness the Duke of Connaught—cordially approves of the Electric Exhibition, believing that it will promote the development of electricity in its application to science and commerce, and will at the same time be interesting to the public." The hon. gentleman expressed his belief that the proposed exhibition would prove of great benefit to the country at large.

Colonel Gouraud seconded the proposition, and expressed the hope that, on account of England's nearer proximity to America than America to France, and also from the language of the two countries being identical, Americans would exhibit in greater numbers than at the Paris Exhibition. He said Mr. Johnson (Mr. Edison's agent) had arrived in London with a larger collection of Mr. Edison's inventions than that now shown in Paris, and would exhibit it at the proposed exhibition at Sydenham.

The proposition was supported by Captain Galton and Sir J. Anderson, and carried with unanimity.

Major Flood Page having explained that M. Cochery had promised that the French Telegraph Department will exhibit if the British Telegraph Department is also to be represented, and having also cited various cases to prove the value, of such an exhibition as that proposed, to the commercial public, on the motion of Mr. McGeorge seconded by Sir John Bennett, the Lord Mayor was thanked for the practical interest he had displayed in this and other similar movements.

The Lord Mayor expressed the pleasure it had given him to place the Mansion House at the disposal of the promoters of the exhibition. He trusted it would be a success, and he believed it would be. So far as he was concerned, any assistance in his power would be gladly given. He did not believe that the proposed exhibition, coming so soon after the Paris Exhibition, would be injured thereby. On the contrary, he believed that the Paris Exhibition had excited a public interest on the subject which would be of benefit to the one about to be held at the Crystal Palace—(hear, hear). As for Government support, he had no doubt that they would be successful in getting it. He saw no reason why the Postmaster-General, who lent his aid to the Paris Exhibition, would not do the same with regard to the one now under consideration, and he believed Mr. Fawcett would do so—(applause). He also thought that they had excellent grounds for making an appeal to the public for the means of providing gold medals, and he was satisfied that such an appeal would be successful—(applause).

The meeting then broke up.

[Having attended this meeting, we are glad to be able to state that there is every probability of the above Exhibition being a great success, and we strongly advise those of our readers who have apparatus to exhibit to apply at once for space.—ED. *Tel. Jour.*]

Reviews.

Electric Lighting by Incandescence, and its application to interior illumination. BY WILLIAM EDWARD SAWYER. New York: D. Van Nostrand. London: E. and F. N. Spon, Charing Cross.

THERE is at present good reason to suppose that electric lighting by incandescence will come into very extensive use. Should the installation of the Swan system at the Savoy Theatre prove a success, as there is every likelihood of its doing, a very great impetus will be given to the future development of the method of lighting. Edison is undoubtedly the pioneer of a successful incandescence system, although to Mr. Swan belongs the credit of having

originated the "incandescent carbon loop," which is employed in some form or other in almost every lamp of the kind yet devised. The fact that Swan, some 20 years ago, devised an incandescence lamp with a thin carbon loop is now very generally known, although Mr. Sawyer, in the historical summary in his book, does not mention it; this however may have been due to inadvertence, as the work in question is practically a description of the systems and principles with which Mr. Sawyer is acquainted. To do Mr. Sawyer justice, he certainly has endeavoured to give full information on the subject, and, moreover (as he states in the preface), he has sought less to indicate defects, than to exhibit accomplishments. The first three chapters in Mr. Sawyer's book are devoted to short descriptions of the various dynamo machines now generally known; amongst others, a machine invented by the author is explained; the principle of this apparatus is that of changing the magnetic power of the soft iron core in a bobbin by bringing a large mass of soft iron near the core, the currents, in fact, are generated in the machine by the rotation of a soft iron wheel with projecting spokes, the bobbins remaining stationary; this machine is, however, stated not to be particularly effective. A modification by the author of the Siemens' machine is also described: its principal object is to reduce the heating which takes place in the ordinary form of machine; this is effected by keeping water circulating in the armature, a device which experiments proved to be quite efficacious.

The chapter on "Carbons for incandescent lighting" contains much useful information on the subject; the whole question of carbons generally, is of such great importance that it requires much more attention than has yet been paid to it. To obtain really good carbons for arc lighting, the manufacture requires, we consider, to be as perfect as for the finest porcelain, indeed it is a subject which porcelain manufacturers might turn their attention to with great advantage.

Mr. Sawyer, in describing his own incandescent lamps, naturally does so at a considerable length; but although various modifications of the same have been made, the latest or "perfected" form does not seem altogether to be a very happy idea, more especially when it comes to be compared with the far simpler inventions of Edison and Swan; no doubt, however, it would work well.

The chapter on the "Division of current and light" is of a rather elementary character, although what information there is, is dealt with in a practical manner. The concluding chapters have reference to "Regulators and Switches," "General Distribution," and "Commercial Aspects," the latter being from an American point of view, *i.e.*, in making comparisons American prices are taken.

Although no doubt there is a considerable amount of information in the work, one of its principal objects is undoubtedly to bring out the Sawyer system as prominently as possible.

Johnston's Illustrations of the Electro-Deposition of Metals. By W. & A. K. JOHNSTON. Edinburgh and London.

THESE diagrams, which form part of the series dealing with electrical science, are very suitable for class instruction, being distinctly and boldly drawn and coloured. The small explanatory handbook, which is written by Mr. Alexander Watt, is well suited for its purpose.

English-French Technical Vocabulary, for Scientific, Technical, and Industrial Students. By Dr. F. J. WERSHOVEN. Libraire Hachette & Cie., 18, King William Street, Strand, London.

THE title of this book explains its contents. It is a most useful work, and no one who is engaged in making translations of, or reading, French scientific works should be without it. It has well supplied a real want.

Correspondence.

CITY AND GUILDS OF LONDON INSTITUTE EXAMINATIONS.

To the Editor of THE TELEGRAPHIC JOURNAL.

SIR,—I was glad to read the letters from "A Student" and "W. M. M." which have recently appeared in your Journal. As a teacher under the City Guilds, I can endorse much that has been stated on the subject of the recent examinations which have proved so discouraging both to pupils and teachers; as a consequence many are deterred from joining the classes, knowing the odds against them.

During last session I taught a class (under the Science and Art Department) consisting of students, strangers to the subject, but succeeded in passing 95 per cent. 1st class.

During the same session I taught one under the City Guilds, in a branch of industry in which the students had all served some years and all were possessed of a good education; in spite of this, only about "25 per cent." succeeded in taking 2nd class elementary certificates. In consequence of this, they and others are deterred from any further attempt, and the class falls through. If *all* the pupils succeeded in passing, the remuneration to teachers is small, seeing the classes are limited to those actually engaged in the industry to which the examination refers. But, when the successes are so small as at present, owing to the high standard required, I would ask where is the remuneration for seven months' work to come from?

I agree with "W. M. M." that the practice of giving ten questions and expecting all to be answered is too much for three hours, and especially when some of the questions are not on subjects included in the syllabus, which at best is a very vague guide for the teacher. I would ask with "A Student" why the syllabus is not arranged to suit each grade, the same as that issued by the Science and Art Department?

Yours truly,

A TEACHER.

[A subscriber, who gives no name or address, writes to us with reference to the latest form of the "Brush Dynamo Machine." We are informed that the apparatus has undergone no essential change since the time when we published an account of it in the Journal. (*See* TELEGRAPHIC JOURNAL, Jan. 15th, 1879).—ED. TEL. JOUR.]

Notes.

TO OUR READERS.

On account of the extreme pressure on our space, it has been decided to issue, on Saturday, the 5th November, an extra supplemental number of THE TELEGRAPHIC JOURNAL. This issue will consist chiefly of notices of British and foreign exhibits at the Electrical Exhibition now being held at Paris, and we think will prove of considerable value to our readers, all of whom, almost without exception, are more or less directly interested in those exhibits. Subscribers will receive this extra number by post as usual.

HEMIHEDRAL CRYSTALS WITH INCLINED PLANES AS CONSTANT SOURCES OF ELECTRICITY.—By MM. Jacques and Pierre Curie.—A section suitably cut from a hemihedral crystal with inclined planes, and laid between two leaves of tin forms a condenser which becomes charged spontaneously on compression. In this manner a new instrument may be obtained, that is, a condenser having special properties. These properties follow from the laws which we have formerly established for the liberation of electricity in hemihedral crystals. We will now show how this instrument may serve as a standard of static electricity for the measurement of charges or capacities. We shall also give an absolute measurement of the quantities of electricity disengaged by tourmaline and quartz at a given pressure.

It is necessary to call to mind three of the fundamental properties which are possessed by a crystal acting as a condenser-source: 1, the two planes are charged with quantities of electricity exactly equal and of contrary signs; 2, when one of the phases is in communication with the earth the other furnishes a given quantity of electricity for a given pressure; 3, the quantity of electricity evolved and the pressure exerted are proportional.

From these propositions it follows that whilst a battery enables us to bring a conductor to a given potential, a condenser-source will furnish a conductor with a determinate quantity of electricity; further, this quantity may be selected beforehand above a certain magnitude.

The quantity of electricity developed by a weight of 1 kilo. placed upon a tourmaline is capable of raising a sphere of 14.2 c.m. to the potential of 1 Daniell. The quantity of electricity disengaged by 1 kilo. upon a plate of quartz perpendicular to a horizontal axis is capable of raising a sphere of 16.6 c.m. to the potential of one Daniell. These numbers measure what may be called the electric powers of the pressure of tourmaline and quartz. The absolute measures have been made with the aid of an apparatus which applied the pressure directly to the crystal. But when it is desired to employ the crystal as a source of electricity it is more convenient to apply the pressure by means of a lever, keeping it all the time in a dry enclosure. It is better not to be concerned about the arms of the lever, and to determine directly, once for all, the quantity of electricity liberated for a weight of 1 kilo. placed at the end of the lever. If the crystal is never displaced it may serve as a standard.

The following method will serve in all cases for finding the quantity of electricity set free: the needle of a Thomson-Mascart electrometer being charged by means of a battery, one of the tin-foils of the crystal is connected with the earth, and the other with one of the couples of sections of the electrometer, and at the same time with a conductor of known capacity. This totality of conductors being insulated, the other couple of sections of the electrometer are placed in communication with one of the poles of a Daniell's element, the other pole being connected with the ground. The needle of the electrometer deviates, and weights acting upon the crystal are added until the needle is brought back to zero. This operation is conducted like an ordinary weighing, by adding or removing weights, the quantity of electricity disengaged depending only on the final pressure.

The tin-foil of the conductor-source, the standard of capacity, and the sectors of the electrometer are then at the potential of 1 Daniell, and the weight which is required for this purpose is known. The same operation is repeated after having suppressed the standard of capacity. The difference of the weights obtained in the first and second case represents the weight necessary to raise the standard of capacity to 1 Daniell.

The method which we are about to describe includes in itself a process for the comparison of capacities. We may, in fact, determine by means of three weighings, the quantities of electricity needful for raising two conductors to the same potential, whence the ratio of their capacities may be inferred.

On the contrary, by charging the two sectors with two different elements, and finding the weights necessary for bringing one and the same capacity to the same potential, we have the ratio of the electrometer forces of the two elements.

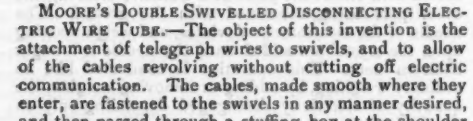
Finally, we may measure a charge with great precision, the body charged being placed in connection with the condenser-source, and with any electrometer, the latter shows the presence of electricity, and is brought back to zero by placing weights upon the condenser.

These methods have the advantage of always bringing back the electrometer to zero. It serves, therefore, merely as an electroscope, and a greater sensitiveness may be employed. The determination of capacities and that of charges is effected thus with precision. The apparatus may also serve for maintaining at the same potential a body which constantly loses electricity, and which must remain insulated.

The constants of a condenser-source are: 1, the quantity of electricity disengaged by a weight of 1 kilo. at the end of the lever; 2, its capacity. To charge bodies of very small capacity, it is advantageous to have a condenser-source of very feeble capacity; a tourmaline or quartz of 0.01 metre in height, and of a few square millimetres of surface cannot reach the capacity of a sphere of 0.01 metre radius and furnish quantities of electricity capable of charging a sphere of 3 metres radius to the potential of 1 Daniell. To charge bodies of a rather greater capacity, there is no great inconvenience in augmenting the capacity of the condenser-source, and it may be obtained by making the quantities of electricity much more considerable. We have constructed a battery of 9 plates of quartz, cut parallel to each other, and perpendicular to a horizontal axis in one and the same specimen of homogeneous quartz. Each plate has about 20 square centimetres of surface. They are placed one upon another, separated by sheets of tin-foil, all those of even numbers being folded back. It results from this arrangement, that on a variation of pressure exerted upon the pile, all the tin-foils of the even numbers are charged with one electricity, whilst those of uneven numbers are charged with the other. By connecting

on the one hand all the tin-foils of the even numbers, and on the other hand all those of the uneven, we have a condenser-source, the capacity of which is that of a sphere of 3.5 metres radius. It easily furnishes wherewithal to charge $\frac{1}{10}$ microfarad to the potential of a Daniell.—*Comptes Rendus.*

MOORE'S DOUBLE SWIVELLED DISCONNECTING ELECTRIC WIRE TUBE.—The object of this invention is the attachment of telegraph wires to swivels, and to allow of the cables revolving without cutting off electric communication. The cables, made smooth where they enter, are fastened to the swivels in any manner desired, and then passed through a stuffing box at the shoulder end of the tubes. On leaving the stuffing boxes and entering the tubes, the cables are stripped of their outer coating. One wire is made spiral and the other



straight, the latter revolving inside of the former, both wires being detached when in the tube. These swivelled tubes may be applied to cables on board of, or suspended from, vessels; or to cables on the bottom of rivers or seas. By the tubes turning with winds or tides they prevent cables from kinking, and also lessen the strain on the wires. The tubes may also be applied to disconnect land wires underground or overhead.

TELEGRAPHIC COMMUNICATION WITH LIGHTHOUSES.—The Lord Mayor presided on the 19 ult. at a meeting in the Mansion House to consider the need of establishing telegraphic communication between lighthouses and light-ships and the shores, with a view to prevent as much as possible loss of life from shipwrecks on the coasts of the United Kingdom. The attendance was not very large.

The Lord Mayor, in opening the proceedings, said he had great pleasure in granting the use of the Egyptian Hall for such a meeting as this. A requisition had been addressed to him signed by, he thought, 1204 gentlemen, requesting him to call a meeting for the purpose of promoting as far as possible telegraphic communication between lighthouses and lightships and the shore. Considering that this was a matter not of local interest alone, but of national interest and importance, he felt bound to do his utmost to forward the object of the meeting. Now that we had telegraphic communication all over the country, and indeed over all parts of the world, it was only fair and right that those who were obliged to spend much of their time in lighthouses on our coasts should have opportunities of having communication with the shore. A great many of the lightships and lighthouses around our coasts were built near quicksands or were built on rocks, and some of them were as far away from the shore as ten, twelve, and fifteen miles. He could conceive nothing more uncomfortable than the position of the watchers in those places without any proper means of communication between themselves and the shore. Guns and rockets answered, perhaps, well enough in fine weather, but they were of little or no use in snowstorms, and during such gales as that which prevailed last Friday. He believed telegraphic communication with those places and the land would be the means of saving not alone a large amount of property, but many valuable lives during every year. The object of the meeting was to provide such a means of communication. To that end it was proposed that the Government should be asked to establish telegraphic communication between our lightships and lighthouses and the shore. The Government might take up—and ought to take up—such a matter as this. The question for the consideration of which the meeting had been called was one of national importance. He hoped, therefore, that the Government would see their way to take up the matter and comply with the request of the meeting—(hear, and applause).

Mr. J. Hobbs, the principal promoter of the meeting, moved:—"That, in the opinion of this meeting, it is a matter of urgent necessity that electric communication should be established between the various lighthouses, light vessels, and the shore, in order that more speedy intimations of vessels wrecked and life and property in peril may be afforded to those ready to come to the rescue."

Mr. A. Shippey, the inventor of the signal balloon, seconded the proposition, and it was carried with unanimity.

Mr. W. H. Lefevre moved a resolution requesting the Lord Mayor to forward the resolutions of the meeting to Mr. Gladstone, with a prayer that the Government should take some immediate practical steps to carry out and to effect such requisite communication, and that the result of such requisition be published.

Mr. G. Nelson (Margate), seconded the motion, which was also carried unanimously.

A vote of thanks to the Lord Mayor concluded the proceedings.

THE ELECTRIC LIGHT AND POWER GENERATOR COMPANY, LIMITED.—An extraordinary general meeting of the members of the Electric Light and Power Generator Company (at which Admiral Sir E. A. Inglefield presided) was held, on October 26th, at the Cannon Street Hotel, for the purpose of considering certain agreements which had been provisionally entered into respecting the purchase of the Maxim Incandescent Light. The price to be paid for it was £54,000, of which £12,500 could be paid in shares. This included all rights in India, America, and the British Colonies, with the exception of Canada. The motion, having been adopted, the chairman invited the shareholders to inspect the Maxim lamp at its present stage of development.

THE PARIS ELECTRICAL EXHIBITION.—Sir Charles T. Bright writes to the London papers that he is informed officially that this Exhibition will close on November the 17th.

A LONG SPAN.—The longest span of telegraph wire in the world is stretched across the Kistnah River from hill to hill, each hill being 1,200 feet high, between Bezorah and Sectanagrum, in India. The span is a little over 6,000 feet in length. The only mechanical contrivance used in stretching this cable across the river was a common windlass.

THE ORKNEY AND SHETLAND TELEGRAPH CABLE.—The *Dacia*, which has now been engaged for some weeks in the work of getting up old telegraph cables lying submerged between Orkney and Shetland, has returned to Shetland, after successfully recovering the second cable. The weather, however, is so stormy that it may be a considerable time before anything can be done towards submerging the new cable. On a former occasion a steamer lay for months in the islands without a single day on which these stormy seas could be got over and a cable laid, and the Shetlanders are now afraid that a similar thing may occur.

THE JERSEY CABLE.—The cable between Dartmouth and Jersey is interrupted. The fault is believed to be close to Dartmouth.

THE ELECTRIC LIGHT IN WESTMINSTER.—The *Westminster and Chelsea News* says that the Westminster District Board of Works have resolved to obtain tenders from the Electric Lighting Companies to ascertain the cost of lighting Parliament Street, the Broad Sanctuary, and Victoria Street, by this system of lighting.

ELECTRIC LIGHTING IN RAILWAY TRAINS.—The first application of electricity to the lighting of railway carriages has been made in one of the Pullman cars on the London and Brighton Railway. The car was filled with eight of Swan's incandescent lamps, which were supplied with electricity from one of Faure's accumulators. The trial was perfectly successful, the clearness and steadiness of the light being quite unaffected by the motion of the train.

CONSTANT GALVANIC ACTION.—Prof. Exner, of Vienna, has lately proved that galvanic elements formed of three elementary substances, one of which is bromine or iodine, give perfectly constant action, and that the electromotive forces exactly correspond to the heat values of the chemical processes. There is no trace of polarisation. Bromine and iodine are also shown to be the worst conductors of electricity at present known. Both bromine and iodine conduct entirely without polarisation (the latter in solid as well as in liquid condition). The conductivity rises rapidly with the temperature.—*Nature*.

CHESTERFIELD AND THE ELECTRIC LIGHT.—Chesterfield, which at night for some weeks has been in a state of total darkness, has decided to light up with the Brush electric light. It is calculated that the large town can be lighted by 34 2,000 candle-power Brush lights, which cover the ground at present occupied by 170 gas lamps, the remainder of the lighting to be done by 36 "Orion" lamps. The capital expenditure for dynamo machines, lamps, driving power, &c., comes to £2,700, and the annual cost of running the same is set down at £550, which includes all the working expenses, the only additional annual charge being that in respect of interest and depreciation, which is set down by the Chesterfield authorities at £250.

THE OXY-HYDROGEN LIGHT BY ELECTRICITY.—Professor Blyth, in the course of some remarks made at the opening of the evening science lectures at Anderson's College, Glasgow, said: "The electric light had so dazzled our eyes and filled our heads that there seemed to be little room left for seeing or considering other methods of converting mechanical work into heat and light through the agency of the electrical current. One such method in particular had been very strangely ignored—the method of lighting by the oxy-hydrogen light, where the gases are supplied by electrolysis. There seems to be no reason why our waterfalls and sources of power should not be used to fill gasometers with the separate or mixed gases oxygen and hydrogen, and then these led, like ordinary gas, to produce the brilliant oxy-hydrogen lime-light, or in some cases to produce for useful purposes the intensely hot oxy-hydrogen flame. Lighting by this method did not labour under the great disadvantage of being difficult to subdivide, and from some rough calculations which he had made, he considered that when the source of power was running to waste at any rate, it would be economical."

GLASGOW AND THE ELECTRIC LIGHT.—At a meeting of the Glasgow Town Council, held on the 5th inst., a proposal to apply to Parliament to "vest the corporation with the exclusive right and privilege of manufacturing and supplying electric light to the inhabitants of the city and suburbs," and in connection with this, to modify the stipulation in the Gas Act as to the illuminating standard of gas, was carried by 28, as against 6 votes for an amendment for delay.

THE ELECTRIC LIGHT IN THE PARIS OPERA HOUSE.—A gala performance has been recently given at the Paris Opera House, with the co-operation of all the eminent electricians now in Paris, in order to test various methods of applying the electric light to the building. The President of the Republic and all the Ministers of State were present, as well as a large number of distinguished visitors. The experiment was incomplete, as the arrangements for the whole building could not be finished in time. Seventy-two Jablochkoff centres were placed below the ceiling round the upper frieze. The steam engines and the electric generators are placed in the opera vaults. The conductors are inclosed in a double lead envelope to guard against any accident that may occur from breakage of the wires and from the high temperature that may be induced by excessive tension. At a second experiment of the electric lighting it was anticipated that the whole house would be lighted by electricity, and much disappointment was therefore expressed at finding gas-light everywhere. The staircase, auditorium, and *foyer* were all more or less lighted in the customary way, the Brush, Swan, and Edison electric lights being but partially employed. The only parts exclusively lighted by the new method were the small saloons at the end of the *foyer*. Not a few visitors expressed themselves decidedly against the electrical system. The light was stated to have an unfavourable effect upon the gilt decorations and bronze work of the house, and it caused the projections to throw shadows of an unsightly length.

THE ELECTRIC LIGHT IN ITALY.—The *Perseveranza*, of Milan, says:—"The President of our Chamber of Commerce has requested Mr. James Shepherd, during his visit to Paris to the Electrical Exhibition, to study, in name of the Chamber, the new applications of the electric light to industries, persuaded that the observations of Mr. Shepherd, whose knowledge in this science is well known, will be to the great advantage of our industries. We feel sure that Mr. Shepherd will fulfil in every way this charge." Mr. Shepherd has also been specially delegated by the Societa d'Incoraggiamento per le Arti e Mestieri, of Milan, to obtain the necessary material (machines and lamps) for a new series of lectures on the electric light, to be held next winter.

New Patents—1881.

4234. "Treatment of india-rubber and of products made therefrom" (coating wire with india-rubber). H. J. HADDAN. (Communicated by U. Kreusler and E. Budde.) Dated September 30. *Complete.*

4420. "Improvements relating to telephone and telegraphic apparatus and circuits." S. PITT. (Communicated by W. R. Patterson and C. C. Scribner.) Dated October 11. *Complete.*

4421. "Apparatus for use upon telephone wires." G. PITT. (Communicated by E. C. Buell.) Dated October 11. *Complete.*

4428. "Telephonic apparatus." A. R. BENNETT. Dated October 11.

4439. "Incandescent electric lamps." J. JAMESON. Dated October 12.

4448. "Electro-magnets for telephonic and other purposes. J. IMRAY. (Communicated by J. Milton Stearns.) Dated October 12.

4450. "An improved method and apparatus for effecting telephonic communications." J. IMRAY. (Communicated by J. Milton Stearns.) Dated Oct. 12.

4454. "Improvements in instruments for measuring electric currents partly applicable to thermometric regulators." J. T. SPRAGUE. Dated October 12.

4455. "Construction of secondary batteries, or apparatus for effecting electrical storage." J. W. SWAN. Dated October 13.

4472. "A new or improved electric meter or apparatus for measuring and registering the quantity of electricity passed through a conductor." C. V. BOYS. Dated October 13.

4473. "Pneumatic signalling apparatus for railway trains." C. D. ABEL. (Communicated by P. Rimacheosky and W. Tagaitschinoff.) Dated October 13.

4478. "Electric lamps." R. HARRISON. Dated October 14.

4496. "Regulators for electric-motors." J. H. JOHNSON. (Communicated by La Société Anonyme, la Force et la Lumière Société Générale d'Electricité.) Dated October 15.

4504. "Electric arc lamps." J. BROCKIE. Dated October 15.

4507. "Insulators for telegraph and other wires." A. E. GILBERT. Dated October 15.

4508. "Improvements in or connected with apparatus or means for the production, collection, or storage and distribution of electricity. parts of which improvements are also applicable to other similar purposes." J. H. JOHNSON. (Communicated by E. H. Parod.) Dated October 15.

4518. "Apparatus for driving or operating sewing machines by electricity." H. H. LAKE. (Communicated by J. J. Journeaux.) Dated October 17.

4533. "Electric lamps." R. R. GIBBS. Dated October 18.

4541. "Improvements in the generation, collection, and distribution of electro-magnetic currents, and in the apparatus employed therein." R. KENNEDY. Dated October 18.

4544. "Manufacture, treatment and application to various purposes of hyponitric, anhydride and apparatus therefor. (Lights for optical telegraphs, &c.) E. TURPIN. Dated October 18. *Complete.*

4552. "Dynamo or magneto-electric machines." P. JENSEN. (Communicated by T. A. Edison.) Dated October 18.

4553. "Method and means for charging and using secondary batteries." P. JENSEN. (Communicated by T. A. Edison.) Dated October 18.

4559. "Apparatus for generating and utilising electricity." T. M. NEWTON. Dated October 19.

4571. "Measurement of electricity in distribution systems." E. G. BREWER. (Communicated by T. A. Edison). Dated October 19.

4576. "Meters for measuring electric currents." E. G. BREWER. (Communicated by T. A. Edison.) Dated October 19.

4582. "Improved means of supplying electricity for lighting purposes in railway and other carriages and steam-boats." A. M. CLARK. (Communicated by J. de Changy née de Deyn.) Dated October 19.

4591. "Mode of generating electricity." H. J. HADDAN. (Communicated by G. Dessaigne.) Dated October 20.

4592. "Improvements in apparatus for generating electricity, and for the production of electromotive power, parts of which improvements are applicable to other purposes." A. MILLAR. Dated October 20.

4607. "Magneto-electric machines." H. F. JOEL. Dated October 21.

4617. "Electric lamps." A. M. CLARK. (Communicated by H. B. Sheridan.) Dated October 21. *Complete.*

4632. "Construction of secondary batteries." J. STELLON. Dated October 22.

4641. "Improvements in targets and in electrical indicating apparatus chiefly designed to be used in connection therewith." W. R. LAKE. (Communicated by A. Boivin.) Dated October 22.

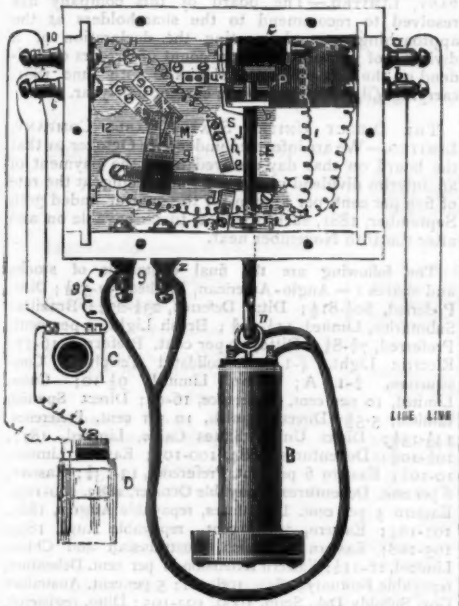
4654. "Electric incandescent lamps." G. G. ANDRE. Dated October 17.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1881.

417. "Railway signalling apparatus." JOHN NEVIL MASKELYNE. Dated Jan. 31. 2d. The object of this invention is to provide simple and efficient means for working the distance and other signals on railways, whereby the stretching and contracting of the wires or rods used for that purpose (whether such variations in the length of the wires or rods be due to atmospheric changes or to other causes) will be compensated for. (Void by reason of the patentee having neglected to file a specification in pursuance of the conditions of the letters patent.)

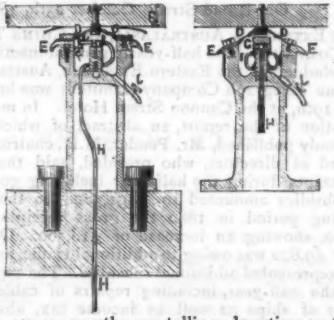
663. "Telephonic apparatus," &c. P. M. JUSTICE. (A communication from abroad by Homer Rice Miller, of America). Dated Feb. 16. 1s. Relates to electric speaking telephones and to signalling mechanisms adapted to be used therewith. The first includes locking mechanisms whereby the operator at any given station may lock out all the stations in the line excepting his own and that with which he desires to communicate. The second part includes an improved electric signal specially designed to be used in connection with electric speaking telephones, but also capable of independent use. The first part of the invention is shown by the figure. In this arrangement the circuit of the transmitter battery is made or broken by the movement of the prongs, *i*, caused by the movement of the switch lever, *e*, which action is necessary when the ordinary Leclanché or a like battery is used with the transmitter. The free end of the lever, *e*, extends through a slot (indicated in dotted lines) in a vertical rod, E. This rod has a hook on the lower end, on which is hinged the telephone (B), and passes through guides, O, O, fixed to the frame. The rod is supported upon a spring, *p*, which rests on the upper guide piece, O, and bears underneath a pin in the end of the rod. The slot in the rod, E, is wider than the switch bar, and allows the spring, *p*, to lift the rod slightly without moving the lever. The tension of the spring is such that the weight of the telephone, B, will depress the rod so as to bring the notch, J, in said rod opposite the end of a bent lever, S, the end of which is fitted to engage with the notch, and lock the rod so that it cannot be pushed up. The armature of the magnet, *t*, is attached to the upper end of the bent lever, S, the lever being so pivoted upon the arm in the case, that the armature when drawn up shall throw the lower end of the lever out of connection with the notch, but when not drawn up, the armature shall fall back by gravity and throw the end of *s* into connection and lock the rod so that it cannot be

raised. It will be understood from this description of the parts that the magnet, *c*, at every station in the line is in the main line circuit. Under ordinary conditions of the circuit, and when no telephones are switched in, the effect of a current is to keep the armature, *t*, drawn up and the rod unlocked. But when an operator at any given station is called, he unhooks and shunts in his telephone. The great resistance of the telephone then brought into the line so weakens the current that it will no longer act upon the electro-magnet, *c*, sufficiently to draw up the armature, and these armatures in the whole circuit of the line will therefore fall back by their own gravity and lock all the rods through which the shunting devices are operated, excepting that from which the telephone has been removed. This happens of course at the station



which has been called, where the operator, having removed the telephone, the rod, E, is lifted by the spring, *p*, sufficiently to raise the notch above the catch without disturbing the shunting lever, *e*, as that moves in the slot. The operator at this station may push up the rod, E, and shunt in his telephone, and is thus able to communicate with another station without liability of interruption by the operator at any other station, or that the communication will be heard except at the two stations in connection. By pushing up the rod, E, the shunting lever, *e*, is lifted so that it leaves the point, *d*, and is moved upon the point, *h*, on which it is held by friction. At the same time the points of the plate are shifted so as to inclose the points, *l* and *k*. This movement of the lever from *d* to *h* shunts in the telephone, and that of plate, *i*, closes the circuit of the local battery.

783. "Electrical conductors." J. PERRY and W. E. AYRTON. Dated Feb. 24. 8d. The invention is designed for the better and more convenient insulation of the electric conductor for the transmission of power in electric railways, and for furnishing an automatic block system without the use of signalmen, and further by that method of insulation to give an easy and simple indication of the position of a train or carriage at any point of its travel, or simultaneously of any number of trains or carriages, and thus to furnish a simple means of electric warning throughout the line. For this purpose the insulated conductor conveying the current is divided into sections fairly well insulated from one another and from the earth, so that leakage to the earth of the current which propels the train can only take place from that section or sections of the rail which are at any moment electrically connected with the continuous insulated conductor. In figs. 1 and 2,



A B is a copper or other metallic rod resting on the top of and fastened to a corrugated tempered steel disc, D, D, which is carried by and fastened to a thick ring, E, E, made of insulating material, either by a metal ring or by six screws and washers. The insulating ring is itself screwed to the top of the circular cast-iron box which latter is fastened to the ordinary sleepers by wooden or iron pins or screws. The rail, A, B, and the corrugated steel discs, D, D, have sufficient flexibility that two or more of the latter are simultaneously depressed by an insulated collecting brush or roller, carried on one or all of the carriages composing the train, or on the single carriage if there be not more than one. Depressing any one of the corrugated steel discs brings the stud, E, which is mechanically and electrically connected with the rod or rail, A, B, into contact with the stud, G, which is electrically connected with the main insulated cable previously referred to, or with one of them if there be more than one. This connection is made either by means of a gutta-percha or other insulated wire, H, H, H, or by H, H, being the main cable itself brought up into the box. To prolong the contact the stud, G, is supported by a spiral spring, as shown in the drawing, so as to be depressed somewhat by F. In the neighbourhood of a train the rail, A, B, is then electrically connected with the well insulated cable or conductor at two or more points or contact boxes, and the train receives electric power through the brushes or rollers under the carriages or under some of them, and the current after passing through a suitable electro-motor on one or all of the carriages, returns by means of one or both of the ordinary uninsulated rails of the line, good electric contact between the successive pieces of rail forming the ordinary permanent way and used as the return wire, being insured by pieces of flexible wire being attached if necessary in addition to the ordinary fish plates.

803. "Dynamic apparatus and motors, &c." RICHARD WALLER. Dated Feb. 25. 10d. The improvements in batteries consist in giving a rotary motion to plates of zinc or copper, zinc or graphite, or any suitable materials, immersed in any of the well-known fluids used in batteries. The improvements in motors consist in placing the armature between two magnets, as usual, but instead of being equidistant

from the poles, it is placed so that it is always in contact with one limb of each of the magnets, between which it has an alternate or reciprocating motion, the upper end being at a distance from these magnets regulated by the length of stroke it is desired to obtain.

City Notes.

Old Broad Street, October 25th, 1881.

EASTERN EXTENSION, AUSTRALASIA, AND CHINA TELEGRAPH COMPANY.—The half-yearly general meeting of the shareholders of the Eastern Extension, Australasia, and China Telegraph Company (Limited) was held on October 19th, at the Cannon Street Hotel. In moving the adoption of the report, an abstract of which has been already published, Mr. Pender, M.P., chairman of the board of directors, who presided, said that the gross receipts during the half-year including government subsidies amounted to £191,580. In the corresponding period in 1880 the gross receipts were £173,020, showing an increase of £18,560. Of this increase £9,820 was owing to additional traffic, and the balance represented additional subsidies. The expenses during the half-year, including repairs of cables and expenses of ships as well as income tax, absorbed £55,230 against £50,384 for the corresponding half-year, showing an increase of £4,846, which was caused by the additional expense requisite for renewals of cables and the maintenance of ships, by additional income tax, and by contributions to the staff insurance company. From the balance of £136,350 had to be deducted £41,595 for interest on debentures and contributions to sinking funds, for redemption of the Australian Government subsidy and Manilla debentures, leaving £94,755 as the net profit for the half-year, as against £95,535 for the corresponding period. This was a decrease of £780. Out of the half-yearly revenue, however, £13,295 had been set aside for the redemption of the Australian Government subsidy and the Manilla debentures, and £2,500 for interest on the Manilla debentures. Only for these special charges, the net revenue would have been at least £14,000 more than it had been. An interim dividend had been already declared of 1¼ per cent. It was now proposed to distribute another dividend of the same amount, together with a bonus of 1s. per share, payable that day. This would make a total dividend of 3 per cent. for the half-year, after paying which they would carry forward £34,830. There was one paragraph in the report to which he desired to draw special attention. He alluded to the one informing the shareholders that the Singapore-Batavia cable had for some time past been a source of anxiety, owing to the increasingly numerous and costly repairs which had been necessary to maintain the line in working order. The directors had decided to replace it with a brass ribboned cable, 580 miles in length, designed to resist the attacks of a marine insect called the teredo, which had been very destructive to the old line. The chairman produced some of the cable after its interior had been scooped out and rendered positively useless by the insect referred to. A satisfactory arrangement had been entered into with the Telegraph Construction Company to carry out the work and pick up existing cable for £95,000, which it was proposed to pay out of revenue by instalments. It was hoped that by this means a large annual saving would be effected on the cost of repairs, and that by the arrangement made for payment of the new cable the dividend to the shareholders would not be interfered with. From £7,000 to £10,000 had been lost during the past three years by the ravages of this little insect. He hoped that when next he met them—six months hence—to be able to report that the new cable was laid, and that the old one had been taken up and repaired in such a way as to render it proof against the ravages of the teredo. It was with much regret that the directors had to report the death of their colleague, Colonel Glover, who had been in the service of the company since its formation, and who was generally esteemed and prized. Mr. W. N. Massey, M.P., vice-chairman, seconded the motion for the adoption of the report, and it was agreed to unanimously. A vote of regret at the loss of Colonel Glover and sympathy with his widow and family, proposed and seconded by shareholders, concluded the proceedings.

THE WEST INDIA AND PANAMA TELEGRAPH COMPANY, LIMITED.—The board of this company has resolved to recommend to the shareholders at the approaching general meeting the declaration of a dividend of 3s. per share on account of arrears of dividend on the first preference shares to 30th June, 1881, carrying £8,708 8s. 2d. to the current half-year.

THE DIRECT UNITED STATES CABLE COMPANY, LIMITED.—We are informed under date October 21 that the board on that day resolved upon the payment of an interim dividend of 5s. per share, being at the rate of five per cent. per annum for the quarter ended 30th September, 1881, such dividend to be payable on and after the 16th November next.

The following are the final quotations of stocks and shares: —Anglo-American, Limited, 52-52½; Ditto, Preferred, 80½-81½; Ditto, Deferred, 23¼-23¾; Brazilian Submarine, Limited, 11⅛-11⅜; Brush Light, 4 per cent. Preferred, 7¾-8¼; Ditto, 10 per cent. Preferred, 16-17; Electric Light, ¾-1; Consolidated Telephone Construction, ¾-1 A; Cuba, Limited, 9½-10; Cuba, Limited, 10 per cent. Preference, 16-17; Direct Spanish Limited, 5-5½; Direct Spanish, 10 per cent. Preference, 14½-15½; Direct United States Cable, Limited, 1877, 10⅛-10¾; Debentures, 1884, 100-103; Eastern Limited, 10-10¼; Eastern 6 per cent. Preference, 13-13½; Eastern, 6 per cent. Debentures, repayable October, 1883, 100-103; Eastern 5 per cent. Debentures, repayable August, 1887, 101-104; Eastern, 5 per cent., repayable Aug., 1899, 105-108; Eastern Extension, Australasian and China, Limited, 11-11¼; Eastern Extension, 6 per cent. Debenture, repayable February, 1891, 108-111; 5 per cent. Australian Gov. Subsidy Deb. Scrip, 1900, 102-105; Ditto, registered, repayable 1900, 102-105; Ditto, 5 per cent. Debenture, 1890, 102-105; Eastern and South African, Limited, 5 per cent. Mortgage Debentures, redeemable 1900, 102-105; Ditto, ditto, to bearer, 102-105; German Union Telegraph and Trust, 10-10½; Globe Telegraph and Trust, Limited, 6¼-6½; Globe, 6 per cent. Preference, 12½-12¾; Great Northern, 11¾-12¼; 5 per cent. Debentures, 103-105; India Rubber Company, 28-29; Ditto, 6 per cent. Debenture, 103-105; Indo-European, Limited, 28-29; London Platino-Brazilian, Limited, 4¾-5¼; Mediterranean Extension, Limited, 2½-3; Mediterranean Extension, 8 per cent. Preference, 9½-10; Oriental Telephone, ⅛-¼; Reuter's Limited, 11¼-12¾; Submarine, 290-300; Submarine Scrip, 2¼-2⅝; Submarine Cables Trust, 97-100; United Telephone, ——; West Coast of America, Limited, 4¼-4⅝; West India and Panama, Limited, 1¾-2; Ditto, 6 per cent. First Preference, 7¼-7¾; Ditto, ditto, Second Preference, 6-6½; Western and Brazilian, Limited, 6¾-7¼; Ditto, 6 per cent. Debentures "A," 110-115; Ditto, ditto, ditto, "B," 99-103; Western Union of U. S. 7 per cent., 1 Mortgage (Building) Bonds, 125-130; Ditto, 6 per cent. Sterling Bonds, 104-107; Telegraph Construction and Maintenance, Limited, 26-27; Ditto, 6 per cent. Bonds, 104-108; Ditto, Second Bonus Trust Certificates, 1⅛-1¼.

EXPOSITION INTERNATIONALE D'ÉLECTRICITÉ.

PARIS, 1881.

LIST OF AWARDS:

(Reprinted in Full from the Official List.)

GRANDS DIPLOMES D'HONNEUR.

France.

Ministère des postes et télégraphes.

Allemagne.

Reichs-Postamt.

Angleterre.

Administration des télégraphes de la Grande-Bretagne (Post Office).

Autriche.

Ministère I. R. du commerce (Administration des télégraphes).

Belgique.

Administration des télégraphes de l'Etat.

DIPLOMES D'HONNEUR.

DÉCERNÉS AUX MINISTÈRES, AUX ADMINISTRATIONS AUX SOCIÉTÉS SAVANTES ET AUX COMPAGNIES DE CHEMINS DE FER.

France.

Ministère de l'agriculture et du commerce (Conservatoire national des arts et métiers.
Ministère de la guerre.
Ministère de la marine et des colonies.
Ministère de l'instruction publique et des beaux-arts (Bureau central météorologique.—Observatoire de Marseille et Observatoire de Paris.)
Ministère des travaux publics (Service central des phares).
Ville de Paris (Préfecture de la Seine).
Ville de Paris (Préfecture de police).
Compagnie des chemins de fer du Nord.
Compagnie des chemins de fer de l'Ouest.
Compagnie des chemins de fer de Paris à Lyon et à la Méditerranée.
Ecole supérieure de télégraphie.

Allemagne (Empire d').

Ministerium der œffentlichen Arbeiten und Herzoglich Braunschweigshes Communion Hüttenamt.

Amérique du Nord (Etats-Unis de l').

United States Signal Office.
Bureau des brevets des Etats-Unis d'Amérique.
Smithsonian Institution (Washington)

Angleterre.

Society of Telegraph Engineers and Electricians.

Autriche (Empire d').

Ministère de la guerre.
Administration de la Société Autrichienne I. R. P. des chemins de fer de l'Etat.

Belgique (Royaume de).

Observatoire royal de Bruxelles.
Compagnie des télégraphistes de campagne.
Ville de Gand.

Danemark (Royaume de).

Direction des télégraphes d'Etat.

Espagne (Royaume d').

Direction générale des postes et des télégraphes.

Italie (Royaume d').

Ministère de l'agriculture.
Ministère de l'instruction publique.
Etablissement de l'Etat pour la fabrication des cartes-valeurs.
Institut royal topographique militaire.

Japon (Empire du).

Ministère des travaux publics (Administration des télégraphes).

Norvège (Royaume de).

Institut topographique de Christiania.

Pays-Bas (Royaume des).

Administration des télégraphes de l'Etat.

Russie (Empire de).

Ministère de la marine.
Département des télégraphes.
Etat-major (section topographique).
Expédition pour la confection des papiers de l'Etat.
Société impériale polytechnique russe.

Suède (Royaume de).

Administration des télégraphes de Suède.
Génie militaire suédois.

Suisse (Confédération).

Administration des télégraphes suisses.
Bureau international des administrations télégraphiques (Berne).

DIPLOMES D'HONNEUR

DÉCERNÉS AUX ÉTABLISSEMENTS INDUSTRIELS.

France.

Breguet.
Christofle et Cie.
Société générale des téléphones.

Allemagne.

Siemens et Halske.

Angleterre.

Eastern Telegraph Co.
Siemens Brothers and Co. limited.
Submarine Telegraph Co.
Telegraph Construction and Maintenance Co. limited.

DIPLOMES D'HONNEUR.

DÉCERNÉS AUX INVENTEURS.

Baudot	France.
Bell (Alexander Graham)	Etats-Unis.
Bjerknes	Norvège.
Deprez (Marcel) ...	France.
Edison	Etats-Unis.
Gramme	France.
Hughes	Angleterre.
Pacinotti	Italie.
Planté (Gaston) ...	France.
Siemens (Dr. Werner)	Allemagne.
Thomson (Sir William)	Angleterre.

DIPLOMES DE COOPERATION

France.

Collége de France (cabinet de physique).
Collége de France (laboratoire d'histoire naturelle des corps organisés).
Conservatoire national des arts et métiers.
Muséum d'histoire naturelle de Paris.
Guebhard (Adrien).
Trève (commandant).

Allemagne (Empire d').

Kœnigliche Eisenbahn-Direction (Berlin).
Kœnigliche Eisenbahn-Direction (Elberfeld).
Kœnigliche Eisenbahn-Direction (Frankfurt am Mein).
Kœnigliche Eisenbahn-Direction (Hannover).
Senats-Commission für Reichs-und auswærtige Angelegenheiten (Bremen).
Universitæt Berlin : Physiologisches Institut.
Technische Hochschule Berlin : Physikalisches Cabinet.
Polytechnikum Dresden : Physikalisches Cabinet.
Universitæt Gœttingen : Erdmagnetisches Observatorium und Physikalisches Institut.
Polytechnische Schule Karlsruhe : Physikalisches Cabinet.
Universitæt Leipzig : Physikalisch-Chemisches Institut.
Universitæt Marburg : Mathematisch-Physikalisches Institut.
Kœnigliche Akademie Munster : Physikalisches Cabinet.
Universitæt Rostock : Physiologisches Institut.
Universitæt Wüerzburg : Physikalisches Institut.
Frœlich (Dr. O.), à Berlin.
Weber (Dr. L.), à Kiel.

Angleterre.

King's College (administration of).
Royal Institution of Great Britain.

Autriche (Empire d').

Administration du chemin de fer de Buschtiehrad à Prague (Bohème).
Kohlfürst et Jetsche.
Mach (professeur), à Prague.
Pfaundler (professeur), à Innsbrück.
Puluj (docteur J.), à Vienne.
Von Waltenhofen (professeur à Prague).

Belgique (Royaume de).

Académie royale des sciences, des lettres et des beaux-arts de Belgique.
Maison des Joséphites, à Mesle-les-Gand.
Musée royal de l'industrie, à Bruxelles.
Société scientifique de Bruxelles.
Université de Louvain.
Université libre de Bruxelles.
Melsens.
Somzée.

Hongrie (Royaume de).

Antolik.

Italie (Royaume d').

Institut royal des sciences et des lettres de Milan.
Musée royal de Florence (cabinet de physique).
Musée royal de Florence (cabinet des anciens instruments d'astronomie et de physique).
Université royale de Gènes (cabinet de physique).
Université royale de Modène (cabinet de physique).
Université royale de Naples (cabinet de physique).
Université royale de Padoue (institut de physique).
Université royale de Pavie (cabinet de physique).
Université royale de Pise (cabinet de physique).
Université royale de Turin (cabinet de physique).
Lycée Spallanzani de Leggio (cabinet de physique).
Lycée Volta de Come (cabinet de physique).
Lycée de Vérone (cabinet de physique) Rossi (Michel-Etienne de).

Pays-Bas (Royaume des).

Administration du service des pompiers, à Amsterdam.
Fondation Teyler (cabinet de physique), à Haarlem.
Bosscha (Johannes), directeur de l'école polytechnique, à Delft.

Russie (Empire de).

Université impériale de Moscou (laboratoire de physique).

Suede (Royaume de).

Université de Lund.

Suisse (Confédération).

Colladon (Daniel).

MEDAILLES D'OR.

Achard	France.
Ader	—
Anglo-American Brush Electric Light Corporation limited ...	Angleterre.
Arlincourt (d')	France.
Bright	Angleterre.
British Electric Light Co	—
Bürgin	Suisse.
Carels frères	Belgique.
Carpentier	France.
Charrière et Cie ...	—
Collin	—
Compagnie des chemins de fer de l'Est ...	—
Campagnie du chemin de fer de Paris à Orléans	—
Compagnie générale belge de lumière électrique...	Belgique.
Compagnie générale d'éclairage électrique	France.
Crompton	Angleterre.
De Vos	Belgique.
Deschiens	France.
Digney	—
Dubosco	—
Ducretet et Cie... ...	—
Dumoulin-Froment ...	—
Elliot frères	Angleterre.
Farcot (Joseph) ...	France.
Félix (Clement) ...	—
Felten et Guilleaume Carlswerk	Allemagne.
Gaiffe	France.
Garnier (H.)	—
Garnier (P.)	—
Geissler	Allemange.
Gloesener (Mlle) ...	Belgique.
Golfarelli	Italie.
Gravier, Kuksz, Leudtke et Grether	Russie.
Gray (Elisha)	Etats-Unis.
Gülcher...	Autriche.
Hardy, Hayet et Lignereux, successeurs ...	France.
Hefner von Alteneck ...	Allemagne.
Heilmann Ducommun et Steinlien	—
Henry-Lepaute ...	France.
Hipp	Suisse.
India Rubber gutta-percha and Telegraph Works Co. limited ...	Angleterre.
Jaspar	Belgique.
Jousselin	France.
Jürgensen et Lorenz ...	Danemark.
Kaiser	Pays-Bas.
Latimer Clark, Muirhead and Co. ...	Angleterre.
Lartigue	France.
Le Boulengé	Belgique.
Lenoir	France.
Menier	—
Mercadier	—
Meritens (de)	—
Meyer	—
Mors	—
Nord-Deutsche Affinerie	Allemagne.
Olsen	Norvège.
Orduna (Carlos de) ...	Espagne.
Otto (pour les moteurs à gaz exposés par la compagnie française des moteurs à gaz, par MM. Fetu et Deliége et par la Gasmotorenfabrik zu Deutz) ...	Allemagne.
Piette et Krizik ...	Autriche.
Pollitzer	—
Postel-Vinay	—
Rattier et Cie.	—
Redier et G. Tresca ...	—
Regnault	France.
Sautter, Lemonnier et Ce	—
Schæffler (Otto) ...	Autriche.
Schubart	Belgique.
Sebert (lieut.-col.) ...	France.
Serrin	—
Société des usines électro-métallurgiques d'Auteuil	—
Société générale d'electricité	—
Société Gramme ...	—
Société lyonnaise de constructions mecaniques et de lumière électrique	—
Sôrensen	Suède.
Swan (J.-W.)	Angleterre.
Tainter (Sumner) ...	Etats-Unis.
Tesse	France.
United States Electric Lighting Co. (système Maxim)	Etats-Unis.
Van Rysselberghe ...	Belgique.

MEDAILLES D'ARGENT.

Administration de l'exploitation des chemins de fer de l'Etat ...	Suède.
Administration du chemin de fer de Lemberg à Czernowitz ...	Autriche.
Apps	Angleterre.
Armengaud aîné ...	France.
Avenarius	Russie.
Ayrton & Perry ...	Angleterre.
Bailey & Puskas ...	Etats-Unis.
Barbier & Fenestre ...	France.
Barbier (E.)	—
Baudet (Cyrille) ...	—
Benoît (Ecole d'horolgie de Cluses)	—
Berjot	—
Billaudot	—
Boivin	—
Bonet	Espagne.
Bonis (Mme)	France.
Bonneau	—
Bonwill (W.-G.-A.) ...	Etats-Unis.
Borrel	France.
Boudet de Pâris ...	—
Brasseur et de Jaer ...	Belgique.
Brotherhood	Angleterre.
Cail, Halot et Cie ...	Belgique.
Cardarelli	Italie.
Carlender	Suède.
Carré (Edmond) ...	France.
Carré (Ferdinand) ...	—
Cazésus	—
Ceradini	Italie.
Chaligny et Guyot-Sionnest	France.
Chambrier	—
Chameroy	—
Chappée	—
Chardin	—
Charpentier	—
Chauvin et Marin Darbel	—
Chenot aîné	—
Closset	Belgique.
Compagnie anonyme des forges de Châtillon et Commentry ...	France.
Compagnie parisienne d'éclairage par l'électricité (ancienne alliance)	—
Connolly Brothers & Mac Tighe	Etats-Unis.
Consolidated Telephone Co. and Maintenance	Angleterre.
Crespin	France.
Daussin	Belgique.
Debrun et Law ...	France.
Dehennault-Bouillet ...	Belgique.
Desruelles et Bourdoncle	France.
Dobrokhotoff-Maikoff	Russie.
Dolbear...	Etats-Unis.
Duchemin	France.
Dujardin	—
Dupont et Alker ...	Belgique.
Eccard	Etats-Unis.
Ecole d'Horlogerie de Paris	France.
Egger	Autriche.
Electric Purifier Co. ...	Etats-Unis.
Electro-dynamic Co. ...	—
Ericson (L.-M.) et Co.	Suède.
Exchange Telegraph Co. Limited	Angleterre.
Farcot (E.-D.)... ...	France.
Fleuriais	—
Frœhlich	Hongrie.
Fuisseaux (de) frères ...	Belgique.
Fyfe	Angleterre.
Geneste Hersher et Cie.	France.
Gérard (A.)	France.
Gérard et Germot ...	—
Ginori	Italie.
Guillemart (Edmond)...	France.
Gurit	Allemagne.
Hache et Pépin-Lehalleur	France.
Hartmann	Allemagne.
Hasler	Suisse.
Héquet	France.
Hubbard	Etats-Unis.
Humblot	France.
Jacquemier	—
Jarriant	—
Johnson and Nephew...	Angleterre.
Kaiserliche General-Direction der Eisenbahnen in Elsass-Lothringen	Allemagne.
Kremenecky	Autriche.
La Horden et Bonet ...	Espagne.
Le Goarant de Tromelin	France.
L'Hôte	—
Lenczewski	—
Létrange et Cie. ...	—
Lermontow	Russie.
Locht Labye (de) ...	Belgique.
Maiche et Cie.	France.
Mandroux	—
Mignon et Rouart ...	—
Mildé fils	—
Monnier	Suisse.
Montefiore-Lévi ...	Belgique.
Moquery	France.
Mouchel	—
Müller	Allemagne.
Naglo frères	—
Napoli	France.
Naudin et Schneider ...	—
Newall	Angleterre.
Noé	France.
Olland	Pays-Bas.
Olry et Grandemange	France.
Petit (G.)	—
Piat	—
Philips (Williams) ...	Etats-Unis.
Pierucci...	Italie.
Racagni et Guglielmini	—
Pond Indicator Co. ...	Etats-Unis.
Rediguet (C.-A.) ...	France.
Raphael (Max) ...	Allemagne.
Rault et Chassan ...	France.
Renaudot et Magniny	—
Reynier...	—
Richard...	Italie.
Robey and Co. ...	Angleterre.
Rouvier	France.
Sabine	Angleterre.
Saxby et Farmer ...	—
Schweizer	Suisse.
Sedlacek	Autriche.
Seguy (Veuve Hector et Fils)	France.
Sieur	—
Société anonyme de constructions mecaniques d'Anzin ...	—
Société anonyme des hauts-fourneaux, fonderies et forges de Franche-Comté ...	—
Société anonyme de Grivegnee	Belgique.
Société anonyme de Lessjofors	Suède.
Société "la Force et la Lumière"	France.
Société nouvelle des forges et chantiers de la Méditerranée ...	—
Société suisse des téléphones	Suisse.
Spagnoletti	Angleterre.
Stœhrer und Sohn ...	Allemagne.
Suisse	France.
Taverdon	—
Terral (jeune)	—
Thiers	—
Thomson Sterne and Co., Limited ...	Angleterre.
Tommasi	France.
Trouvé	—
Van den Kerchove ...	Belgique.
Van Wetteren (Nicolas)	Pays-Bas.
Varral, Elwel et Middleton	France.
Vavin	—
Voss	Allemagne.
Weill (F.)	France.
Welsch	Belgique.
Wennman	Suède.
Western Electric manufacturing Co. ...	Etats-Unis.
Weston Electric Light Co.	—
Willot	France.
Wittwer et Wetzer ...	Allemagne.

MEDAILLES DE BRONZE.

Aboilard	France.
Académie d'aérostation météorologique ...	—
Alamagny et Oriol ...	—
Albaret	—
Amsler	Suisse.
Arnould...	France.
Avoiron et Clement ...	—
Bacle	—
Baillehache (de) ...	—
Ballat	—
Ball	Etats-Unis.
Bandieri	Italie.
Barbey	France.
Barluet et Cie	—
Barrière et Cie... ...	—
Bartelous	Belgique.
Baudet (Cloris) ...	France.
Beau (Nicolas) ...	—
Beaufils	—
Bédollière (de la) ...	—
Bellet (Louis)	—
Bernard...	—
Bessand et Cie... ...	—
Bigeon	—
Biloret et Mora ...	—
Bisson	—
Bizot	—
Blakey, Emmot and Co.	Angleterre.
Blix	Suède.
Blondeau	France.
Blouzon...	—
Borgmann	Russie.
Boudreaux	France.
Boulet et Cie	—
Bourdin (J.)	—
Bourne	Angleterre.
Brand	Belgique.
Brunnschweiler et fils...	Suisse.
Buss	France.
Cacheleux	—
Callaud	—
Cance	—
Canson et Montgolfier	—
Carue	—
Castelli	Italie.
Cavignato	—
Cefrey	France.
Chapuis...	—
Charle	Belgique.
Chavet	Etats-Unis.

Chertemps	France.
Chollet et Rezard ...	—
Chutaux	—
Combettes (de) ...	—
Compagnie des bronzes	Belgique.
Compagnie française du celluloïd	France.
Compagnie internationale des téléphones de Bruxelles... ...	Belgique.
Cordier (aîné et fils) ...	France.
Cottens	—
Courtot	—
Coxeter and Son ...	Angleterre.
Croon et Cie	Pays-Bas.
Cumming	Etats-Unis.
Cuypers...	Allemagne.
Dalifol et Cie	France.
Dandigny	—
Daville (Auguste) ...	—
Dawans et Orban ...	Belgique.
Debayeux	France.
Deffez	—
Delahaye	—
Delamotte	—
De la Roche et Mayrhofer	—
De la Taille	—
Delaurier	—
Delaye	—
Deleuil	—
Dolgorouki (Prince) ...	Russie.
Delsaux...	Belgique.
Denis-Fouillet	France.
Dereviankine	Russie.
Desguin	Belgique.
Dion	Etats-Unis.
Dœrffel	Allemagne.
Dopfeld	France.
Dorizon	—
Douce et Cie	—
Dubos	—
Ducousso frères ...	—
Dupont (J.)	Belgique.
Echenique	Espagne.
Eliaers	France.
Engel	—
Engstrom (Edward) ...	Suède.
Estienne	France.
Evely	Belgique.
Fautrier...	Italie.
Fein	Allemagne.
Ferry et Millet ...	France.
Flechet et Cie	Belgique.
Fontenilles	France.
Forest...	—
Foxcroft	Angleterre.
Frémond	France.
Frenais	—
Frion et Thierré ...	—
Galante...	Espagne.
Gallet (Victor)... ...	France.
Gary	—
Gauthier	—
Gautret	—
Geissler (Nicolas) ...	Russie.
Gerosa	Italie.
Geesbergen (Jean) ...	Belgique.
Gerzabeck, Zeller et Cie	Allemagne.
Giesbers	Belgique.
Giraud...	France.
Gits	—
Godage (Hans) ...	Norvège.
Goppelsroeder... ...	Suisse.
Grandfeld	Autriche.
Gras	—
Grassi et Beux ...	—
Gravollet	Autriche.
Grin	—
Grivolas	—
Grosguénaint	—
Guggemos	—
Guichard et Cie ...	—
Hammelle et Fleutelot	—
Hedges-Killingworth...	Angleterre.
Hempel	France.
Holmgren	Suède.
Hoosach Tunnel tri-nitroglicerine works	Etats-Unis.
Horn	Allemagne.
Hospitalier	France.
Hubin	—
Humblot et Terral ...	—
Hunebelle	—
Hurtu et Hautin ...	—
Hutchinson & Co. ...	—
Jacobs	Pays-Bas.
Jacquez...	France.
Jean	—
Joly	—
Jordery	—
Journaux	—
Jowa	Belgique.
Kern	France.
Keiser et Schmidt ...	Allemagne.
Kovaco...	Russie.
Legarde	France.
Laneuville et Pers ...	—
Lapointe	—
Latchinoff	Russie.
Leveissière et fils ...	France.
Leblanc et Loiseau ...	—
Leclérc	—
Leduc	Belgique.
Legat	France.
Leguay	—
Lemoine	—
Lessing...	Allemagne.
Létard...	France.
Le Tellier et Vertraet	—
Letourneau	—
Liébert	France.
Lionnet...	—
Loiseau (Edouard) ...	—
Loiseau et Guichard ...	—
Luizard...	—
Mangenot	—
Mantelet et Joly ...	—
Marcillac	—
Mathieu	—
Michel	—
Milchsack et Cie. ...	Allemagne.
Mills	Pays-Bas.
Mirand fils	France.
Mirandolle	Pays-Bas.
Monti	France.
Mouchère fils	—
Mourlon	Belgique.
Mugna	Italie.
Nacfer	France.
Neujean	Belgique.
Nigra	Italie.
Noblet	France.
Noel	—
Lawlor (O.)	Angleterre.
Olin et fils	Belgique.
Ollivier	France.
Olsen	—
Oré et Chagnoleau ...	—
Papin	—
Parent (Georges) ...	—
Partz	Etats-Unis.
Paterson	Angleterre.
Patry	France.
Pelletier	France.
Perez-Blancas	Espagne.
Pérille	France.
Perin-Grados	—
Petit (Pierre)	—
Photo-Relievo & Co. ...	Etats-Unis.
Piedras y Macho ...	Espagne.
Planche fils	Belgique.
Radiguet et fils ...	France.
Raffard	—
Ragosine	Russie.
Raikem	Belgique.
Ransomes, Head & Jefferies	Angleterre.
Rebiceck	Autriche.
Richez et Cie	Belgique.
Rose	France.
Roullier et Arnoult ...	—
Rous	—
Sabel	Angleterre.
Sacre	Belgique.
Sambourg	France.
Samson...	—
Sax	Angleterre.
Schneider et Cie ...	France.
Serravalle	Italie.
Seure	France.
Skrivano	Russie.
Slouguinoff	—
Smith	Angleterre.
Société anonyme de câbles électriques, système Berthould, Borel et Cie...	France.
Société anonyme de Skultuna	Suède.
Société anonyme le Nickel	France.
Société générale pour la fabrication de la dynamite	—
Société parisienne et fonderie et laminage	—
Société d'études et constructions électriques zurichoise	Suisse.
Solignac et Cie. ...	France.
Sommati di Monbello	Italie.
Stiff and Sons	Angleterre.
Stoesser...	France.
Tagaitschinoff... ...	Russie.
Tegnander	Suède.
The Dowson Economic Gas Company ...	Angleterre.
Tichomiroff	Russie.
Tissandier	France.
Tostrup	Norvège.
Vaillant, Leclerc et Gourdon	France.
Vanderbiste	Belgique.
Van der Ploeg	—
Vandevelde	—
Van Hulle	—
Vauzelle et fils	France.
Videcoq	—
Vigouroux et Andriveau	—
Waelput	Belgique.
Wallis & Stevens ...	Angleterre.
Weiller et Montefiore Lévi	France.
Whitecross Wire Company	Angleterre.
White house Mills ...	Etats-Unis.
Williams	—
Wilk	Allemagne.
Wisse Piccaluga et Cie.	Pays-Bas.
Wolff	France.

THE TELEGRAPHIC JOURNAL AND ELECTRICAL REVIEW.

VOL. IX.—No. 211.

THOMAS ALVA EDISON.

THOMAS ALVA EDISON.

AMERICA has long been renowned as the land of mechanical invention; but she has conspicuously distinguished herself during the last few years. This has been largely due to the genius of Mr. Edison, who, by his many remarkable inventions, which it is needless to enumerate, has drawn upon himself and his native country the attention of both the learned or unlearned in the whole world. Mr. Edison is the chief figure amid a perfect host of inventors, great and small, who swarm in the United States; and being also a self-made man, he has been almost worshipped by his countrymen. There was something almost magical in these inventions, which appealed powerfully to the imagination; and when it was known that their author was a self-taught telegraph clerk, who looked a mere boy, it is no wonder that Edison was lionised as he has been. Such a character, like Balsac in fiction or Mademoiselle Bernhardt in art, breaks the commonplace monotony of existence, and lets loose those hidden springs of enthusiasm which are ever ready to welcome anything in the shape of a prodigy.

Thomas Alva Edison was born at the village of Milan, in Erie County, Ohio, on February 11th, 1847, and is therefore nearly 35 years of age. His father was of Dutch descent, and had been in turns a tailor, a nurseryman, and a dealer in land and lumber. His mother, though born in Massachusetts, was of Scotch parentage and a woman of good education, she having formerly been a school teacher in Canada. Indeed, she may be regarded as the sole teacher of her boy, for the two months' regular schooling he received is of no account. Like many other famous men, therefore, Edison was much indebted to his mother.

Like many other famous men, too, Edison, as a boy, was fond of amusing himself alone. He was a great reader, and did not complain about the nature of a book, so long as it was a book of some kind. It is related that he once set himself to read through an entire subscription library, beginning at the bottom shelf, and that he had penetrated several shelves before his project was given up. At ten we find him reading books of chemistry, and when he began the world as a train-boy on the Grand Trunk Railway of Canada and Central Michigan, he littered the empty baggage car, which served him as a store for his fruit and newspapers, with old retorts and bottles of chemicals, which he had picked up at odd times for a few pence.

With the Yankee instinct for "getting on" abnormally developed, he purchased a second-hand printing press, together with a quantity of type, and started a newspaper of his own, entitled, "The Grand Trunk Herald." Of this literary venture he was proprietor, editor, staff, publisher, printer, and devil, in his own person; and it obtained the flattering celebrity of being noticed in the London *Times* as the only paper printed and circulated in a railway train.

During this time he was investigating everything mechanical which came under his notice. He pored over the working of the telegraph, he studied the locomotive, and once ran the train between two stations himself. He also continued his reading, and "Newton's Principia," side by side with "Ure's Dictionary of the Sciences," and "Burton's Anatomy of Melancholy," could have been seen on the news-boy's shelf. He also took to chemical experiments in an evil day for the pursuance of his news business, for one day he accidentally set fire to the baggage-car, and the irate conductor put a summary end to his literary career and his scientific researches, by ejecting him and all his traps, chemicals, fruit, and printing press included, out of the car.

From his first acquaintance with it, the telegraph has exercised a strong attraction over him; and it was a turning-point in his life when, after he had gallantly rescued a child of the Port Clements station-master from being run over on the line, the grateful father undertook to teach Edison how to telegraph.

Edison was meanwhile turning his versatile talents to account as a shoemaker, a trade which he had picked up in some unaccountable way; but the work was distasteful, and he took a situation at Port Huron, Michigan, as a telegraphist.

From this time, for several years, he led the life of a travelling operator, now engaged in Canada, now in Indianapolis, now in Cincinnati, or Louisville, now in Memphis and Boston. Many amusing stories are told of his ready ingenuity and gawky appearance during this period. His mind was now fairly directed towards invention, and he acquired the habit of experimenting and thinking at night, after the duties of the day were over. At Memphis in 1864, we are told, that he devoted himself to the problem of duplex telegraphy, and, after having his studies and ideas frequently ridiculed and discountenanced by his ignorant fellow clerks and masters, he found his way to Boston in 1868, where he met with more encouragement and better success. "In spite of his peculiar fashions of passing his time," says a writer in *Scribner*, "he had become one of the most accomplished operators. He overcame obstacles put in his way on account of a somewhat uncouth appearance, and soon took an important position. He had up to this time dallied with a number of ideas he has since perfected, acquired a beautiful, small, rapid handwriting, as clear as print, and gratified considerably his desire of seeing the world. He had once been on the point of sailing for South America, from New Orleans, but had only been prevented by an accident. A new period commenced for him. Some small things of his succeeded—a dial instrument for private use, a chemical note-recorder, and others, and he began upon a vibratory principle of telegraphing. He commenced a great epoch in one's history—to believe in himself. Up to this time he had not done so. 'I did not think,' he says, 'that I was competent.' He was not successful, however, in an important trial of his duplex system, and was soon again adrift."

He went to New York in a disconsolate mood, and happening to be in the office of the Gold and Stock Company at a critical moment when their indicator was out of order, he repaired the instrument, and secured an engagement with the company. He soon invented a printer of stock which was adopted by the company, and from that time his progress was assured. He was also taken up by

the Western Union Telegraph Company, and retained by both companies at a handsome salary, to give them the first bid for his new inventions. He was now in a position to start a manufactory of his own at Newark, New Jersey, where he made all his gold and stock printers, and employed about 300 men; but the business left him too little leisure for invention, so he sold out and retired to Menlo Park, a new settlement of a few yellow-painted wooden houses on the Pennsylvania Railway in New Jersey, about 20 miles from New York. Here he built a large barn-like structure upon the top of a hillock, and fitted it out as a workshop and laboratory, the workshop being on the basement and the laboratory upstairs. The former is well supplied with tools, lathes, and workmen, who are kept busy making patterns and transforming the inventor's ideas into wood and iron; while the latter is stocked with books, experimental apparatus, and so many chemicals besides that it looks like a wholesale drug-store. He is said to buy a quantity of every new drug which appears in the market, for he does not know how soon he may want it in his experiments; but we suspect that he has a passion for surrounding himself with chemical compounds, just as a bibliophile has a passion for surrounding himself with books. In this laboratory, Edison has everything at his command; he is provided with several skilful assistants selected by himself for their zeal and ability, who are ready to test all his suggestions, and also to offer ideas of their own. He has workmen to make all the instruments and models he may require, and what is more he can give all his time and thought to the work he has in hand. Menlo Park is an inventors' paradise not to be found in any other country; and though this fact tends to lessen our surprise that Edison should have accomplished so much, we ought not to forget that it was his own genius and industry which first created the place. We need not dwell at length on his several inventions, for they have been so frequently cited and published of late, that they are familiar to most electricians. Before the invention of the loud-speaking telephone and the phonograph had enormously extended his fame, Edison was becoming known on this side of the Atlantic as a rising young genius, sure to do wonders in his day, and his gold and stock printer, his electric pen, electro-motograph, and quadruplex system, had given him a solid reputation as an electrical inventor. Then came the invention of the carbon telephone, the phonograph, and microtasimeter, which swelled his fame to world-wide bounds, and finally, as if to inflate it to bursting point, he telegraphed the enthusiastic but rash announcement across the Atlantic in October, 1878, that he had solved the problem of the divisibility of the electric light, and would soon be able to light up our homes by electricity, at a mere fraction of the cost of gas. A year or two has since passed by, and although the letter of the announcement cannot yet be said to have been fulfilled, yet, by dint of ceaseless energy, Edison has gone far towards accomplishing what he anticipated. The exhibit at the Paris Electrical Exhibition shows that he has overcome some of the obstacles in his way, and that he has attained a large measure of success. The invention of the phonograph is undoubtedly one of the most transcendent flashes of mechanical inspiration that ever entered into the mind of a man; and the loud-speaking telephone, with its carbon transmitter and prepared chalk receiver, is one of the greatest marvels ever constructed out of dead matter. On hearing it and examining it, we cannot but wonder at the daring hardihood and patience of invention which has made it what it is.

Edison has taken out in all about three hundred patents. He has been called "the young man who keeps the road to the Patent Office hot with his footsteps." His plan appears to be to patent all the ideas that occur to him, whether tried or untried, and to trust to future labours to select and combine those which prove themselves the fittest. The result is that the great bulk of his patents are valueless in point of practicability; but they serve to fence the ground in from other inventors.

From our illustration, it will be seen that Edison's appearance is youthful in the extreme. "When you go to his house," says a writer, "he may very possibly answer your inquiry for 'Mr. Edison' himself; or, if not, you will be shown into his laboratory, where you will find him among his assistants; and if you try to guess which is Mr. Edison, your best plan will be to select the least obtrusive person in the group. His figure is slight and young-looking, though the face, from its long habit of concentration, has an old look; he has a frank, cordial expression, and, like most men of great powers, can be almost a boy when his attention is turned away from his absorbing interests. But when he is not aroused, he seems to retire within himself, as if his mind had travelled a long way off, and his attention comes back slowly. He has the peculiar pallor of a night worker, and if you stay with him through the night, you will find him as bright at the end of the vigil as at the beginning." His power of work is something extraordinary, it being usual for him to work sixteen hours each day, and at a stretch; as, for example, when he invented the phonograph, he has eschewed sleep for days and nights on end. More than one assistant has already succumbed to the strain of trying to keep up with him.

Mr. Edison is married, and has three children, two boys and a girl, one of each sex being nicknamed respectively Dot and Dash. He is young, and as he comes of a long-lived stock, notwithstanding the severe strain to which he subjects his powers, we may reasonably expect that he will continue to bestow many useful inventions on his age. We can assure him that should he ever fulfil his intention of coming to England, he will meet with a cordial reception from English electricians.

THE CRYSTAL PALACE ELECTRICAL EXHIBITION.—The Postmaster-General has arranged with the Crystal Palace Company to exhibit the whole of the instruments now exhibiting at the Paris Exhibition by the British Postal Telegraph Department. In addition, there will probably be shown in actual use several of the best fast-speed instruments employed by the department.

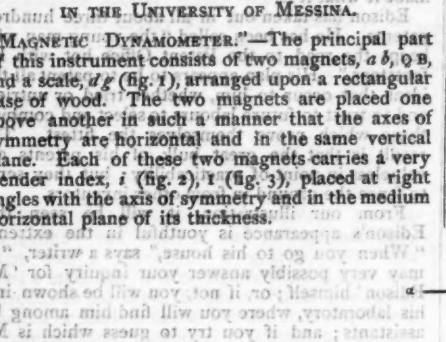
THE ELECTRIC LIGHT.—The Duke of Sutherland has decided upon lighting his residence at Trentham with the electric light supplied by the British Electric Light Company.

THE PARIS ELECTRICAL EXHIBITION.

FOREIGN SECTIONS.

DR. ANTONIO COSTA SAYA, PROFESSOR OF PHYSICS IN THE UNIVERSITY OF MESSINA.

"MAGNETIC DYNAMOMETER."—The principal part of this instrument consists of two magnets, *a b*, Q B, and a scale, *d g* (fig. 1), arranged upon a rectangular base of wood. The two magnets are placed one above another in such a manner that the axes of symmetry are horizontal and in the same vertical plane. Each of these two magnets carries a very slender index, *i* (fig. 2), I (fig. 3), placed at right angles with the axis of symmetry and in the medium horizontal plane of its thickness.



The first magnet, *a b* (fig. 1), is formed of a long, narrow and thin spring of steel, which is fixed horizontally at one end, *a*, to a perpendicular support, *a c*, and left free at the other extremity, *b*; the latter carries the index, *i*, which by bending *a b* slides along the scale, *d g*; this scale is finely divided into equal graduations, and can be raised or lowered. In order to secure the scale in its exact position before experimenting, the second magnet, Q B, is removed from its support and the scale fixed by means of a set-screw, so that its zero corresponds precisely to the index, *i*, of the spring, *a b*. The plane upon which the magnetic dynamometer is placed during experimentation ought to be very firm and it should not be affected by the oscillations of the floor.

The second magnet, Q B, is placed upon a movable toothed support, by means of which it can be aproximated to the other magnet, *a b*, or removed from it. Upon the button of the rack-work is a set-screw to fix the support of the magnet, Q B, at the desired height.

In such an instrument the magnetic attraction or repulsion is counterbalanced by the elasticity of flection. The following experiments will exemplify the method of working the apparatus.

First Experiment.

The magnet, Q B, is removed from its support, and removed so far from the instrument that it cannot act upon the spring-magnet, *a b*; then it can be demonstrated that the inflection of *a b* is proportional to the force which produces it. At *b* there is suspended a very slender copper wire of the form of S for the purpose of lowering the index, *i*, a short distance, *l*, from the scale, *d g*; to the weight there is appended a second one, *h*, of equal weight, so that the index can be lowered to, 2 *l*, and by means of other weights this lowering can be extended to any degree sufficient for the use for which the instrument is intended. If the chain of weights, *b h*, be removed the index will return to the zero of the scale, *d g*. This experiment shows that within certain limits the inflections of the spring, *a b*, are proportional to the force which produces them.

Second Experiment.

The magnet, Q B, is placed upon its support in a direction parallel to *a b*, as is indicated in fig. 1, and in such a manner that its magnetic pole, Q, corresponds to the contrary magnetic pole, *b*, of the spring-magnet, *a b*; moreover it is placed near the scale, *d g*, before which extends the index, I, fixed to a ring. This arrangement enables the index, I, to be placed at a convenient distance from the scale upon which are marked the different heights at which the magnet, Q B, is placed on raising or lowering it.

This being done and the magnet, Q B, being always kept in a parallel position, it is brought to a certain distance from the spring, *a b*, in such a manner as to cause a lowering of the index, *i*; and preserving this, the magnet, Q B, is moved slowly backwards and forwards to find the position which corresponds to the maximum depression of the index, *i*; in such movements the axis of the magnet, Q B, ought not to change its distance from the other magnet, *a b*, nor be removed laterally. When such a position of the magnet, Q B, is found, it is fixed with a set-screw and then the magnetic dynamometer is ready for experiments, by means of which it is demonstrated that magnetic attraction varies inversely as the square of the distance.

Third Experiment.

The magnet, Q B, is removed from the magnet, *a b*, until its index, *i*, marks a slight depression, *l*, and then the corresponding distance, *d*, of the two poles, *a*, *b* (measured from the distance of the two indices, *i*, I), is noted.

This being done the magnet, Q B, is approached to *a b*, it being always kept in the same parallel position so as to reduce to $\frac{1}{4}\,d$ the distance of the two poles, *a b*; it will then be seen that there is a depression of the index, *i*, quadruple that formerly obtained, on 4 *l*. Thus it is shown that the magnetic attraction between the two poles, Q and *b*, varies in the inverse ratio of the squares of their distances. On reducing then the distances of the two poles to $\frac{1}{3}\,d$, the depression of the index will be 9 *l*, or ninefold the first, as it ought to be according to the law in question.

In making such experiments it is necessary to avoid a too close proximity of the magnets, and the first depression, *l*, must be very small.

If it is desired to make a large number of experiments in confirmation of the said law, the following method may be employed.

Fourth Experiment.

Let *l*, l^1, be equal depressions of the index, *i*; and *d* d^1, the relative distances of the two poles, Q and *b*, then in accordance with the known law

(1) $\qquad l, d^2 = l^1, d^{12}$

whence (2) $\qquad d^1 = d\sqrt{\frac{l}{l^1}}$

Let us suppose that at the known distance, *d*, there is a known depression, $l = 0{\cdot}2$ of the scale by the index, *i*, then (2) we have

(3) $\qquad d^1 = d\sqrt{\frac{0{\cdot}2}{l^1}}$

If we wish to know the distances, d', d'', d''', &c., of the two poles, *a* and *b*, corresponding to the depressions, $l' = 0{\cdot}4$; $l'' = 0{\cdot}6$; $l''' = 0{\cdot}8$, &c., it is sufficient to substitute for l^1, in the equation (3) the numerical values of the distances, d', d'', d''', and approximating successively the pole, Q, to the pole, *b*, there are obtained the depressions corresponding to the index, *i*, in conformity with the law above mentioned.

Magnetic Repulsion.

To prove the same law for magnetic repulsion, the magnet, Q B, is placed above *a b*, in the position B′ Q′ (fig. 1), parallel to *a b*, so that the two homonymous poles, *b* and B, of the two magnets may correspond in the same perpendicular. To the latter is adapted the ring which carries the index, I, laying hold of the pole, Q, which in this new position will correspond to Q′.

By this arrangement of the two magnets, the index, *i*, of the magnet, *a b*, will be depressed by the magnetic repulsion between the two similar poles, B′ and *b*. The experiments may be made in the same manner which was employed for demonstrating the law of magnetic attraction.

Distribution of Magnetism in a Magnet.

The instrument in question is useful for studying the distribution of magnetism in a magnet, Q B. For this purpose it is not placed in a parallel position, but in such a manner that the axes of symmetry of the two magnets, *a*, *b*, Q B (fig. 4), may be situated horizontally at different heights, and in two planes, vertical and perpendicular. This position of the magnet, Q B, is called the perpendicular position, to distinguish it better from the parallel position.

Let Q B be placed in the perpendicular position under *a b* (fig. 4) so that the two contrary poles, *b*, *q*, may correspond in the same vertical, and at such a distance as to have a depression of the index, *i*, equal to 9 *l*. This being done, the needle, Q B, is moved very slowly, so that its different sections may correspond successively in the same vertical of the pole, *b*; the index, *i*, will be raised till it returns to zero, and if the movement of Q B is then continued, the index will be pushed in the opposite direction, passing above zero, and rising till the homonymous pole, B, of the magnet, Q B, will be placed below *b*.

A T-shaped support assists in maintaining the magnet, Q B, in the perpendicular position, so that the above-mentioned experiment can be made convenient.

In this and other experiments, it is useful for the magnet, Q B, to be adapted to a scale for better determining the corresponding section, in the same vertical plane, which passes through *b*, when the index, *i*, marks a positive or a negative deviation or none.

Magnetic Actions through Bodies.

It is easy to demonstrate with this instrument that magnetic action is propagated without becoming weakened through many bodies. It is sufficient to interpose the bodies, holding them in the hand, between the poles of the two magnets placed in the parallel position (fig. 1) so as to have a certain depression of the index, *i*. The index will then be seen to remain motionless on interposing between the two poles copper, glass, wood, &c., and to

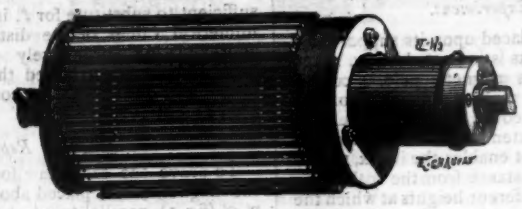


FIG. 1.

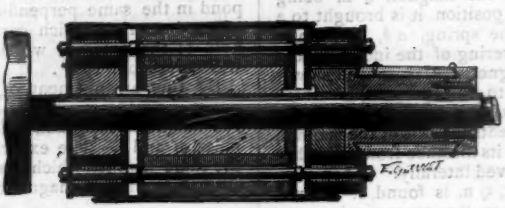


FIG. 2.

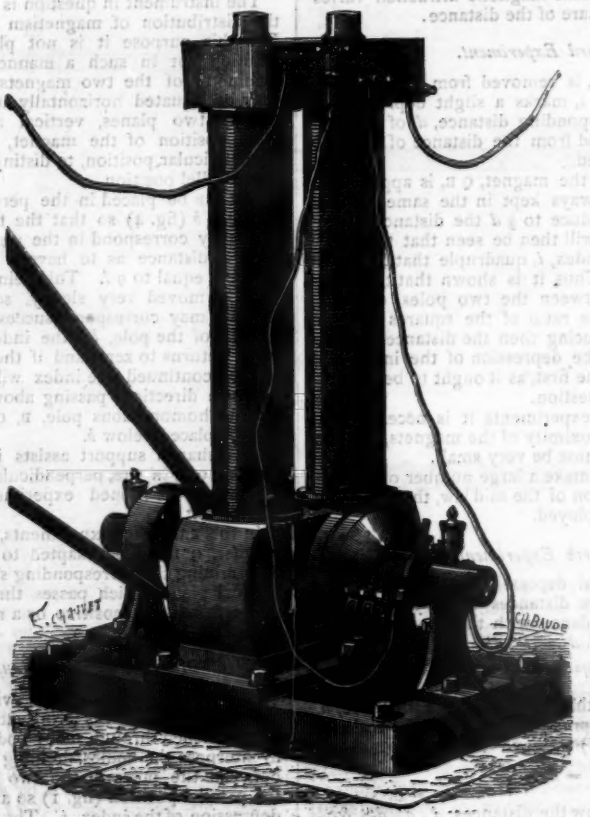


FIG. 3.—EDISON'S EXHIBIT.

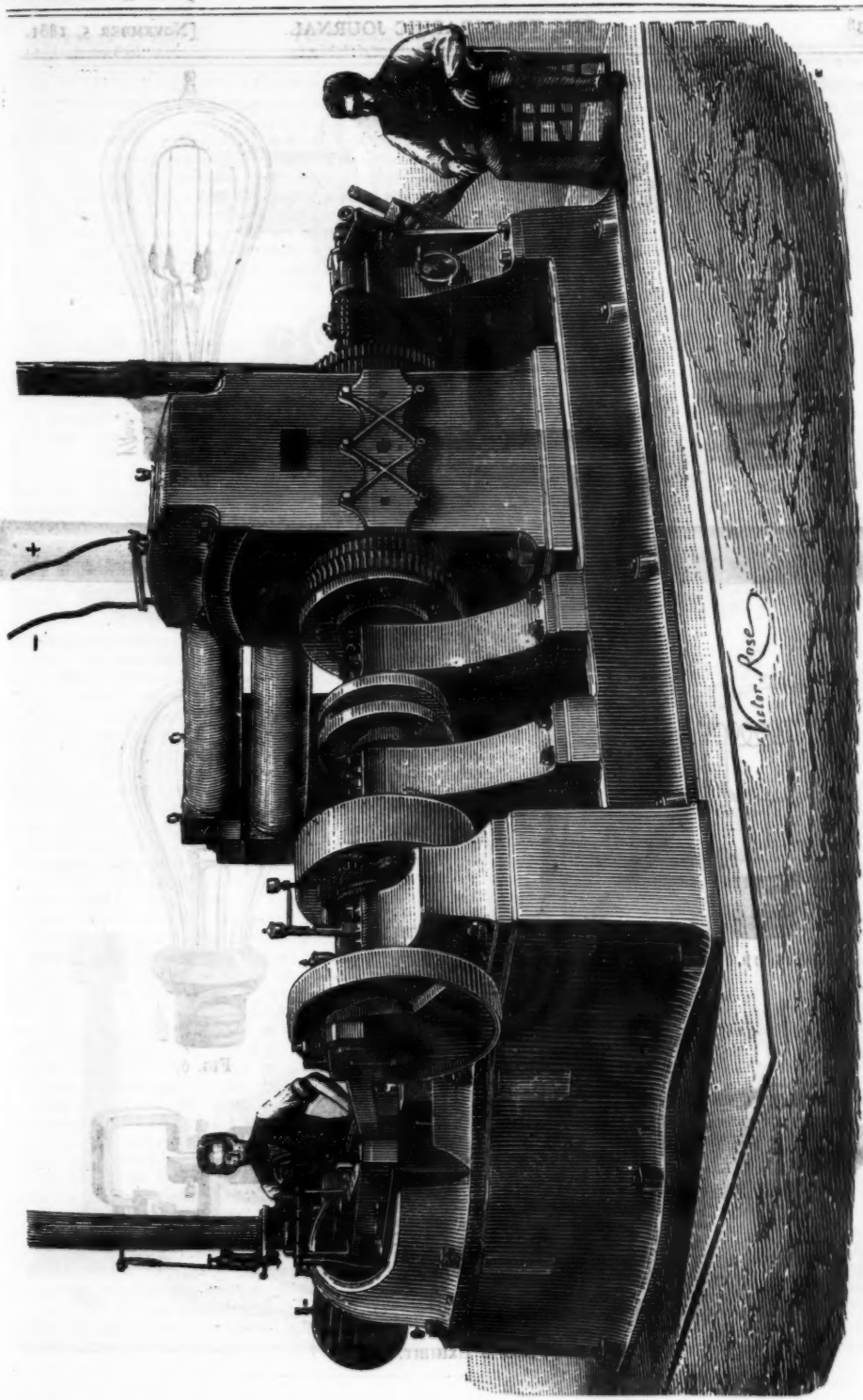


Fig. 34.—Edison's Exhibit.

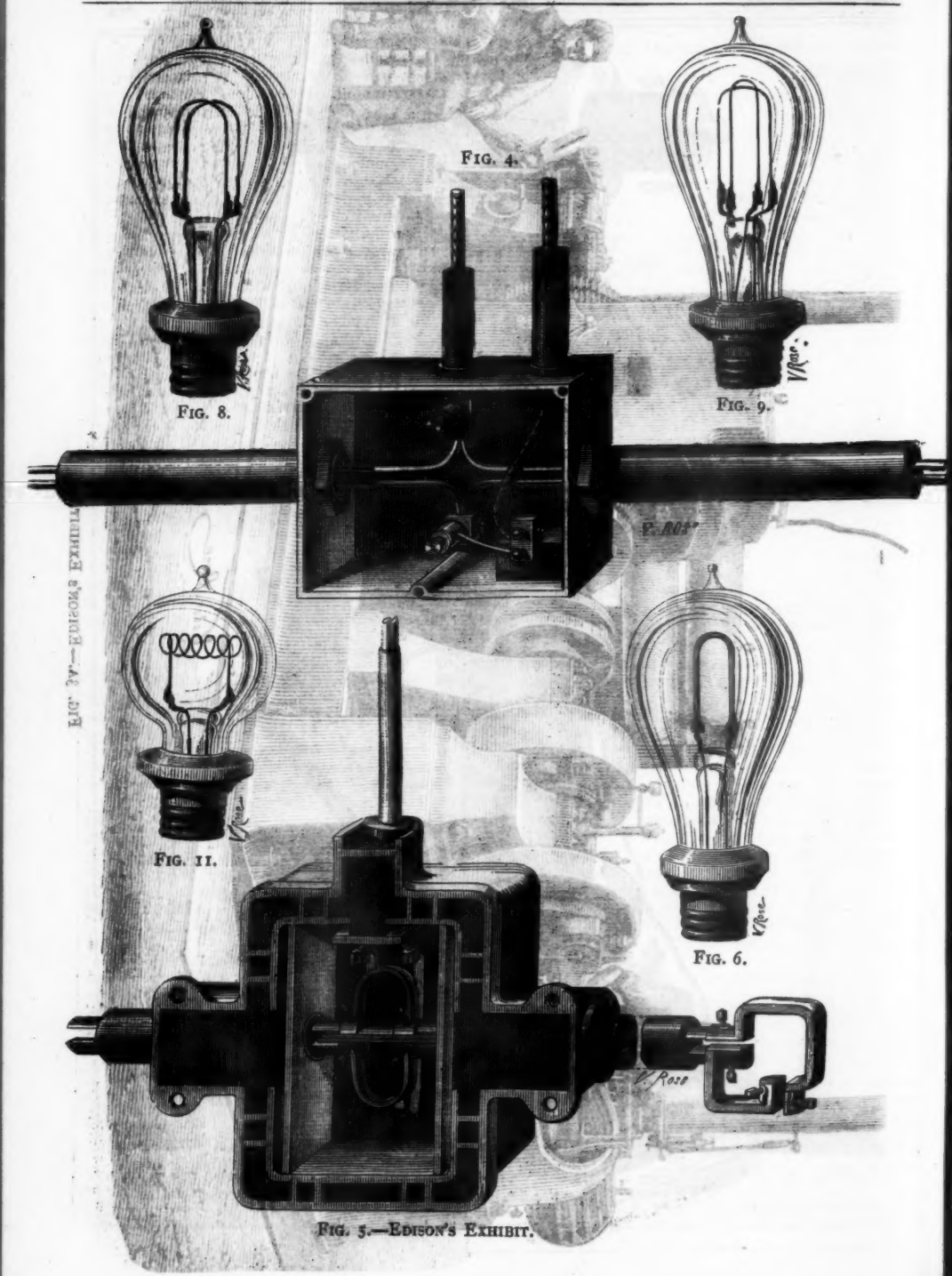


FIG. 4.

FIG. 8.

FIG. 9.

FIG. 11.

FIG. 6.

FIG. 5.—EDISON'S EXHIBIT.

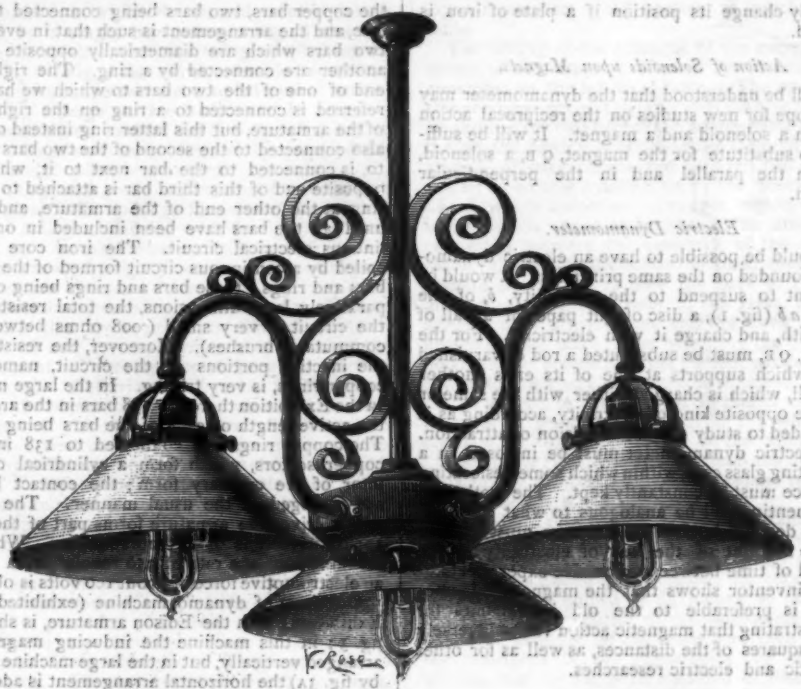


FIG. 13.

FIG. 12.—EDISON'S EXHIBIT.

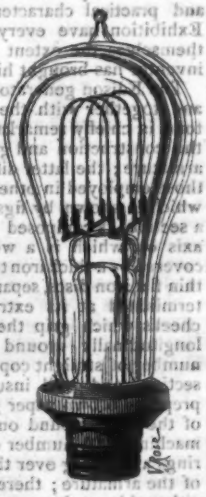


FIG. 10.

FIG. 7.

suddenly change its position if a plate of iron is inserted.

Action of Solenoids upon Magnets.

It will be understood that the dynamometer may give scope for new studies on the reciprocal action between a solenoid and a magnet. It will be sufficient to substitute for the magnet, Q B, a solenoid, both in the parallel and in the perpendicular position.

Electric Dynamometer.

It would be possible to have an electric dynamometer founded on the same principles. It would be sufficient to suspend to the extremity, *b*, of the spring, *a b* (fig. 1), a disc of gilt paper or a ball of elder pith, and charge it with electricity. For the magnet, Q B, must be substituted a rod of varnished glass, which supports at one of its ends another pith ball, which is charged either with the same or with the opposite kind of electricity, according as it is intended to study electric repulsion or attraction. The electric dynamometer must be inclosed in a well-fitting glass case, within which some desiccating substance must be constantly kept. The method of experimenting will be analogous to what has been already described. But special care must be had to take account of the loss of electricity in the interval of time between successive experiments.

The inventor shows that the magnetic dynamometer is preferable to the old instruments for demonstrating that magnetic action varies inversely as the squares of the distances, as well as for other magnetic and electric researches.

EDISON.

"ELECTRIC LIGHT APPARATUS."—The whole system of electric lighting by incandescence, as worked out by Mr. Edison, is of a very ingenious and practical character, and visitors at the Paris Exhibition have every opportunity of seeing for themselves the extent of perfection to which the inventor has brought his original ideas.

The Edison generator, which is of colossal size, and, together with the driving engine, weighs 17 tons, is chiefly remarkable, as regards novelty, for the construction and general arrangement of the armature; the latter differs in many respects from those employed in other machines. This armature, which is shown by figs. 1 and 2 (the latter being a section) is composed in the first place of an iron axis on which is a wood cylinder; the latter is covered by a thick iron tube formed of a series of very thin flat iron discs, separated by paper. This tube is terminated at its extremities by two large iron cheeks, which grip the plates laterally. Arranged longitudinally around the iron cylinder are a number of straight copper bars of trapezoidal cross section, and well insulated from each other by prepared brown paper; these bars take the place of the wire wound on the armatures of ordinary machines. A number of well insulated flat copper rings are strung over the central shaft at each end of the armature; there are half as many rings on either side as there are bars, that is to say, if, for example, there were 50 bars, then there would be 25 rings on either side of the armature. The left-hand rings are connected to the left-hand ends of the copper bars, two bars being connected to each disc, and the arrangement is such that in every case two bars which are diametrically opposite to one another are connected by a ring. The right-hand end of one of the two bars to which we have just referred is connected to a ring on the right hand of the armature, but this latter ring instead of being also connected to the second of the two bars alluded to, is connected to the bar next to it, whilst the opposite end of this third bar is attached to a fresh ring at the other end of the armature, and so on until all the bars have been included in one continuous electrical circuit. The iron core is thus coiled by a continuous circuit formed of the copper bars and rings; these bars and rings being of comparatively large dimensions, the total resistance of the circuit is very small (·008 ohms between the commutator brushes). Moreover, the resistance of the inactive portions of the circuit, namely the copper rings, is very trifling. In the large machine in the Exhibition there are 138 bars in the armature, the active length of each of the bars being 3½ feet. The copper rings are connected to 138 insulated copper sectors, which form a cylindrical commutator of the ordinary form; the contact brushes are arranged in the usual manner. The engine which drives the armature forms part of the whole apparatus and is of 125 horse-power. When the machine runs at a rate of 350 revolutions a minute an electromotive force of about 100 volts is obtained.

One form of dynamo machine (exhibited at the Exhibition) with the Edison armature, is shown by fig. 3; in this machine the inducing magnets are arranged vertically, but in the large machine (shown by fig. 3A) the horizontal arrangement is adopted.

The conductor for conveying the current in the Edison system consists of a metal tube about 3 inches in diameter, containing a cheap insulating substance, and traversed by two half-round copper conductors about an inch in diameter. This main pipe, which can be as long as required, is buried along the main streets, and at the side streets it has derivations branching off, to supply the current to the places it is required to illuminate. The branching off is effected by means of the arrangement shown by fig. 4; this consists of an iron box into which the conductors are led and connected to insulated terminals, to which latter are also connected the branch wires as shown. It will be noticed that the connection of the lower main wire with the right-hand branch wire is not direct, but is made through the medium of a short conductor; this latter is of lead and acts as a safety valve; should, from any cause, the strength of the current flowing out to the branch become too great, then the lead conductor melts and causes a disconnection. The whole box is hermetically sealed up so as to keep the inside perfectly dry. The conductors which are led off into the houses, are of small diameter (about 2 or 3 millimetres) and are joined on to the branch conductors, much in the same way as the latter are joined to the main conductors.

Fig. 5 shows the most perfect form of arrangement of the junction boxes for leading off from the main conductors; the general principle, it will be seen, is similar to that indicated by fig. 4.

The forms, &c., of the Edison incandescent lamps are very numerous. Figs. 6 and 7 show the simplest

arrangement, in which the incandescent carbon is formed by a single horse-shoe. Fig. 8 shows a double horse-shoe, the two being coupled up for "quantity." Fig. 9 also shows a double horse-shoe, but in this case the two are coupled up in "series." In fig. 10 a large surface is obtained by means of four horse-shoes coupled up for quantity, and in fig. 11 a large surface is obtained by employing a long filament coiled into a spiral.

Fig. 12 shows a wall bracket lamp, formed with a single glass bulb, and fig. 13 a chandelier with 3 lamps. A large chandelier with 80 lights is shown by fig. 14. In cases where a folding wall bracket lamp, as shown by fig. 15, is required, special contrivances are necessary to keep up the continuity of the circuit at the folding joints, A and B; the way in which this requirement is effected is shown by figs. 16 and 17, the former also showing the arrangement of the tap for turning the current on and off. Referring to fig. 16, which shows the tap, the object aimed at was a means of breaking the current without causing the disjunction to produce a destructive spark; this object was attained by effecting the break through the interposition of a copper cone which terminated the screw of the tap and which moved away from between two thick copper plates which were in the line-circuit; the continuity being thus broken between two points, both of which had large surfaces, the resulting spark produced but little effect. Fig. 18 shows another form of a tap on the same principle; this tap is provided with a lead safety wire (seen towards the top left hand corner of the figure), which melts if the strength of the current exceeds a safe value. Figs. 19 and 20 show a tap for main circuits; in this case there are three cone pieces, which all move together when the tap is turned, so that the continuity of the circuit is broken at six points simultaneously.

For coal-mining purposes, Mr. Edison has designed the lamp shown by fig. 21; in this arrangement the lamp and connections are kept covered with water contained in a glass vessel, so that contact of the gas in the mine with any part of the lamp likely to become broken is impossible.

In cases where it is required to be able to diminish or increase the light given by a lamp, the arrangement shown by figs. 22 and 23 is employed; this consists simply of a number of carbon bars of different sizes, any one of which can be inserted in the circuit by turning a disc piece (shown separately in the lower part of fig. 23), which makes a contact with the carbon giving the necessary resistance. The whole set of bars are covered by a perforated cylinder (shown in fig. 22), which allows the air to circulate and keep the bars cool.

The regulation of the current strength Mr. Edison effects by means of a system of testing. This arrangement is shown by figs. 24 and 25. Referring to fig. 25, it will be seen that the rheostat, *e*, is in circuit with the inducing magnets of the dynamo machine, A; by this means the action of the latter can be regulated at will by introducing in the circuit referred to, more or less resistance according as the current in the circuit of the lamps is observed to be increasing or decreasing from its normal strength. The resistances of the rheostat are seen in fig. 24 underneath the right-hand table. They are made of thick wire, and are wound on open frames to avoid heating as much as possible.

The testing of the potential of the current in the circuit of the lamps is effected by the help of the apparatus on the left-hand table. The principle of this arrangement is as follows:—Referring to fig. 25, by shifting the two bars of the commutator *j*, over to the left, the battery, D, is connected through a resistance, *i*, of 50,000 ohms, and through the galvanometer, *n*, so that a deflection of the needle is produced, which deflection is brought within readable limits by the shunt resistance, *h*, the latter being connected between the terminals of the galvanometer; the steady deflection obtained represents a definite potential. If now the bars of the commutator, *j*, be shifted over to the right, then the battery, D, is disconnected and the wires, *c c*, connected in their place; then by noting the deflection obtained, the potential of the current passing in the conductors, *a a*, can obviously be obtained in terms of the battery, D. In practice all that is necessary in order to keep the potential in the wires, *a a*, constant, is to keep the bars of the commutator, *j*, over to the right, and then to keep the deflection constant by varying, when necessary, the resistance in the rheostat, E.

Instead of keeping the current constant by the galvanometer observation, this can be done by observing the photometric value of the light obtained from a lamp placed in the circuit; for this purpose the photometer shown by fig. 26 can be employed. By placing the chariot of the photometer at any particular position on the scale, and then varying the resistance in the rheostat, E (fig. 25), it is obvious that any required standard of illumination can be kept up in the lamps on the circuit.

We understand that Mr. Edison's English representative has taken the commanding premises at 57, High Holborn, for the purpose of exhibiting the entire Edison apparatus. Every opportunity will be given for thorough tests of the system being made by those interested in the subject.

GIOVANNI SERRAVALLE.

"AUTOMATIC APPARATUS FOR COVERING WIRES." The great demand for silk or cotton-covered copper wires for electro-magnetic apparatus has led Signor Giovanni Serravalle, mechanician of the Physical Cabinet of the University of Messina, to devise an automatic apparatus which, without any supervision, should maintain perfect uniformity and continuity of action whilst covering the entire length of any wire whatever. The machine is driven by an electric motor, for which a couple of Bunsen elements furnish a sufficient current. The complete apparatus is composed of two parts, viz., the machine which covers the wire and the motor.

The first is represented in section in fig. 1. The axle, B B, is set in motion by means of the wheel, A A, which communicates with the motor by means of an endless band (not shown in the figure). This axle transmits its motion, on the one hand, by means of a series of wheels at *c e*, to two cylinders, *i i*, which revolve in the direction indicated by the arrows, and on the other hand by means of the wheel, A, to the coverer, E, which is

composed of another axle, L L″, parallel to the former and carrying a disc, N N¹, to which are adapted four bobbins full of silk for covering the wire. The wire enters into I, and traverses the interior of the axle, L L′, and is compressed by the two cylinders, *i i*′, which by their movement drive it outward. The silk threads coming from the bobbins after having passed through various little apertures lined with glass, reunite, two from one side and two from the other, on O, which is on the same axle from which they wrap themselves on the metal wire which comes slowly forward.

In order that the cylinder, *i i*′, may take wires of different sizes, the iron ring which holds the upper cylinder is united to the fixed part of the machine. This cylinder can within certain limits be moved away from the lower one, *i*, whilst the spring, *r*, always presses upon it. Whenever this adjustment is not sufficient for wires which are too thick or too slender, the cylinders may be substituted by others.

FIG. 14.—EDISON'S EXHIBIT.

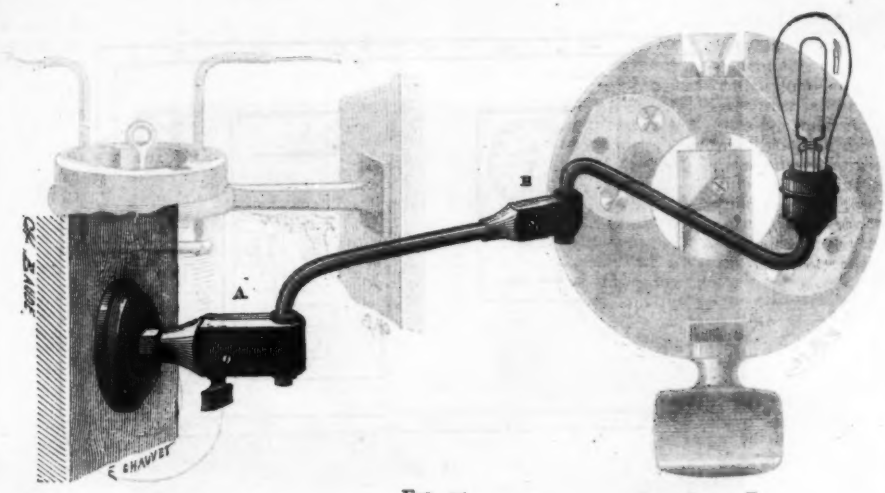


FIG. 15.

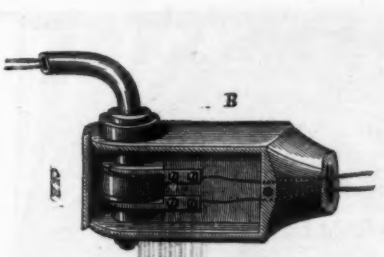


FIG. 17.

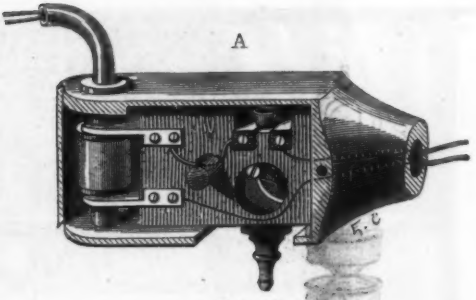


FIG. 16.

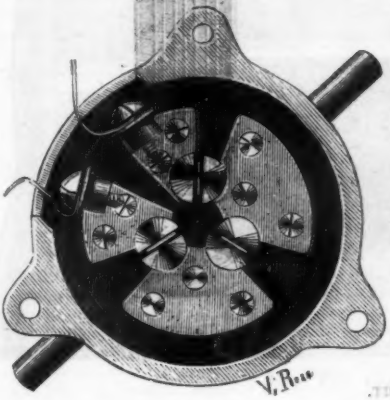


FIG. 20.

FIG. 19.

EDISON'S EXHIBIT.

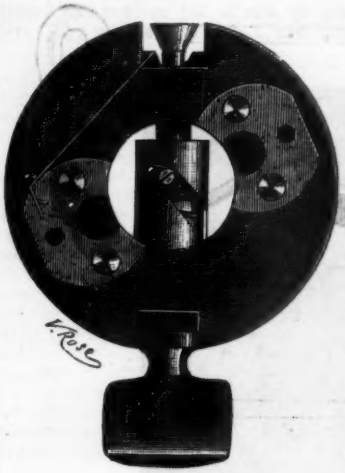


FIG. 18.

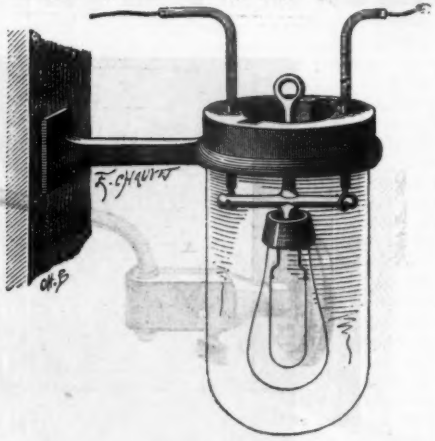


FIG. 21.

FIG. 22.

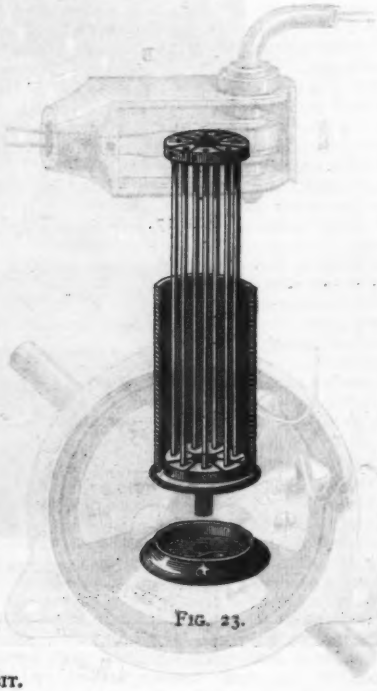


FIG. 23.

EDISON'S EXHIBIT.

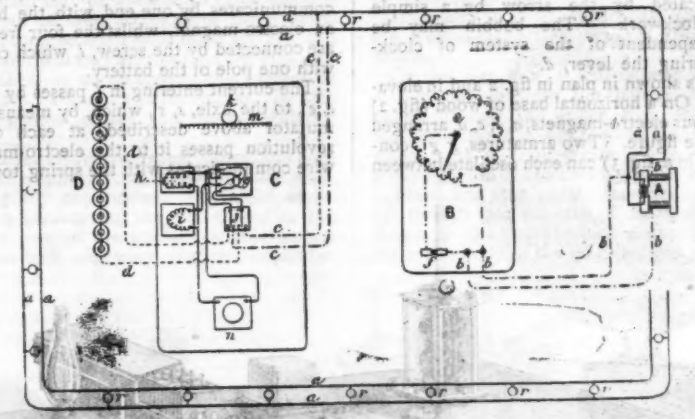


Fig. 25.

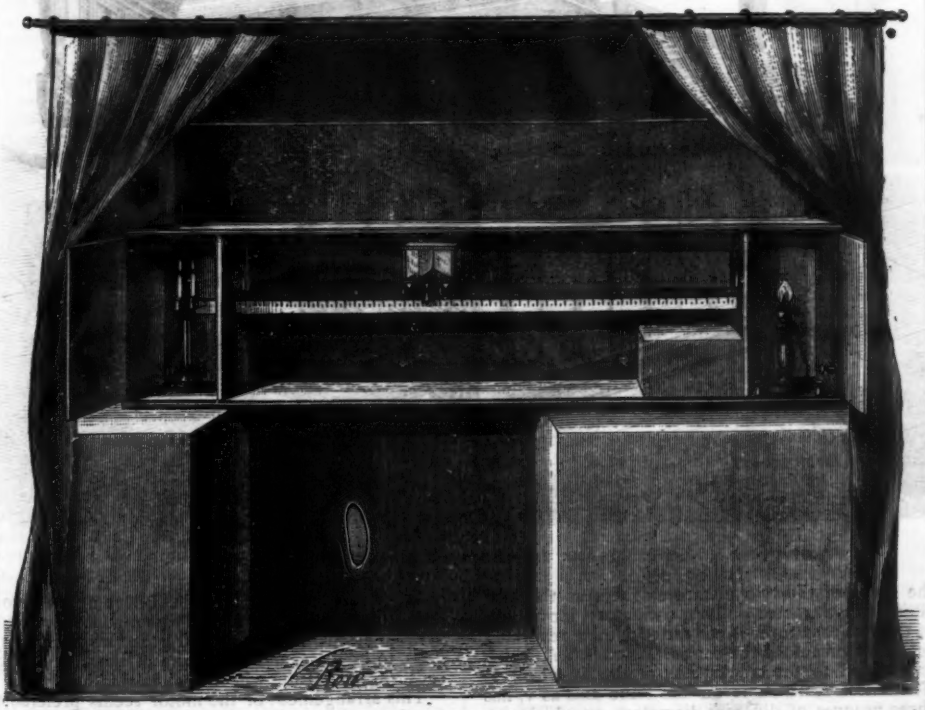


FIG. 26.—EDISON'S EXHIBIT.

The wire thus covered coils itself upon a large bobbin, R, which always tends to revolve in the direction indicated by the arrow by a simple system of clockwork. The bobbin may be rendered independent of the system of clockwork by lowering the lever, *d*.

The motor is shown in plan in fig. 2 and in elevation in fig. 3. On a horizontal base of wood (fig. 2) are fixed the four electro-magnets, *a*, *b*, *c*, *d*, arranged as shown in the figure. Two armatures, *g* g^1, connected below (in *n*, fig. 3) can each oscillate between the poles of the two electro-magnets as they are alternately attracted. This oscillatory movement of the two armatures is converted into a revolving action by means of the connecting-rods, *i* i^1, which are geared to the cranks, *s* s^1, of the fly-wheel, v. The wheel, *r*, which is on the same axis as v, has three grooves of different diameters, on which can be fitted the driving cord for the transmission of the movement. The same axle carries the commutator, consisting of two projections soldered upon the axle in two different vertical directions, and in different planes, so that they may come in contact respectively with the four springs, *n*, n', n'', n''', each of which communicates by one end with the helix, forming an electro-magnet, whilst the four free extremities are connected by the screw, *l*, which communicates with one pole of the battery.

The current entering in *l* passes by the supports, *e*, e', to the axle, *s*, s', which, by means of the commutator above described, at each quarter of a revolution passes it to the electro-magnet, whose wire communicates with the spring touched by the corresponding projection, so that in a complete revolution of the axle, the current passes successively to the four electro-magnets, causing the two armatures, *g*, g', to oscillate, and by means of the connecting rods, *i*, i', to set the wheel, *s*, s', in rotation.

This arrangement of the motor seems preferable to the one usually adopted, since it combines efficiency with simplicity. In fact, the current does not pass simultaneously into the different coils as in other motors of this kind, but passes successively and without any deviation in such a manner

FIG. 24.—EDISON'S EXHIBIT.

that the electro-magnet acquires the maximum magnetic force. It will be easily understood how the above system may be adapted to three electro-magnets instead of four, arranged in three pairs. The axle will then be fitted with three springs, and the commutator will be formed of six springs and three projections, so as to convey the current to each coil at each sixth part of a revolution. By this arrangement greater power and more regularity would be obtained.

But the entire apparatus, as just described, does not satisfy the condition that it should work without requiring any supervision. It might easily happen that a breakage of the silk thread or the exhaustion of one of the bobbins should occur. In these cases it is necessary that the apparatus

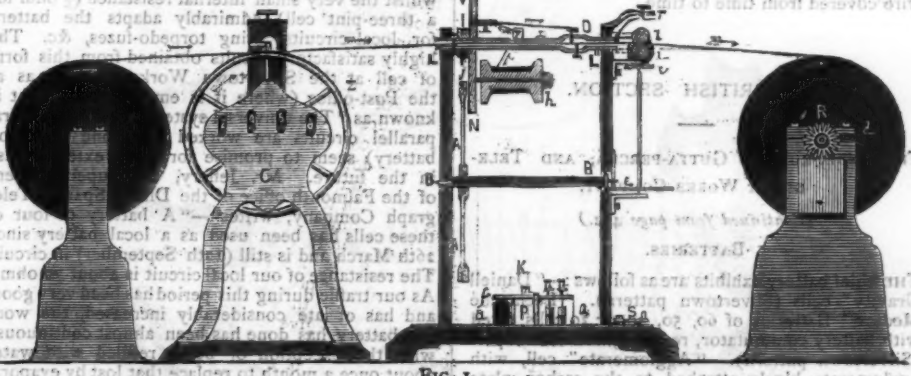


FIG. 1.

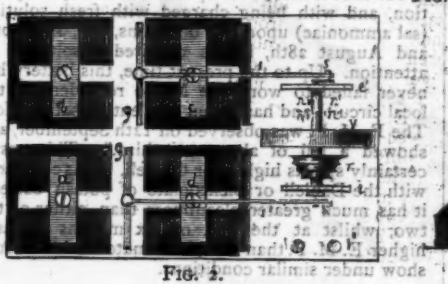


FIG. 2.

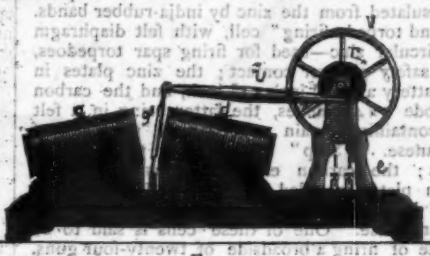


FIG. 3.

should stop automatically. This object is attained in the simplest manner by means of a mercurial interrupter, K (fig. 1). This is formed of an electro-magnet, *a*, which can draw down the lever, *m*, by attracting the armature fixed to it. The lever carries on its other arm two iron screws, *n*, *n'*, the ends of which plunge into two small cups of mercury; of these screws, *n* is always in contact, whilst the other comes into contact only when the lever is depressed. When the lever is in this latter position, the electric current before arriving at the motor passes through the two cups of mercury, as the apparatus is in action, until the circuit is closed by the metallic arch terminating in the two screws, but at the moment when it enters into action the electro-magnet, *a*, presses down the lever, *m*, on the side of the screw, *n'*, separating it from the mercury, with which it was in contact, and by breaking the circuit, brings the motor to a stand.

It remains to be shown how the current passes in the electro-magnet, *a*, when a thread of silk is broken.

On the disc, N, N', it will be seen that the thread of silk coming from the bobbin, *h*, after having passed through the orifice, *x*, enters first at *o* into another orifice made in the end of the rod, *n*, which when it is free, is pressed by a slender spring, always kept in contact with a metal disc, V.

There are four rods corresponding to the four silk threads (for the sake of clearness, only one is shown in the figure) which communicate through the entire body of the machine with one pole of the battery, whilst the disc, V, communicates with the other pole, including the electro-magnet, *a*, in the circuit.

As long as all the silk threads pass through the rods, they are all drawn away from the metal disc, V, and therefore the circuit is interrupted; but if one of the threads fails and leaves its respective rod, the latter comes in contact with the metal disc, the circuit is closed, and the electro-magnet, *a*, exerts its action, and brings the motor to a stand.

In order that the circuit may remain open when the apparatus is not in use and thus the waste in the battery be stopped, a mercurial interrupter is included in the last circuit, and the lever, *m*, is placed in unstable equilibrium by means of a screw, *g*. Thus the electro-magnet, *a*, fulfilling its office,

interrupts the circuit simultaneously without turning the lever backwards.

To render the apparatus as complete as possible, two other pieces have been added which, though not indispensable, are of great advantage, especially when the machine has to work for a lengthened period.

The first of these is an electric bell, which is intended to give notice when a silk thread is broken, and that the machine has suspended its work. This is done by means of a little column, *p*, added to the interrupter, K, which plays the part of a commutator, and causes the current to pass from the motor to the bell; the latter will then sound until some one comes to open the circuit, which is done by means of an interrupter, *s*.

The other piece is the counter, C (of ordinary construction), which measures the length of the wire covered from time to time.

THE BRITISH SECTION.

The India-rubber, Gutta-percha, and Telegraph Works Company.

(Continued from page 412.)

Batteries.

The chief battery exhibits are as follows:—"Daniell Gravity" cells (Silvertown pattern). "Leclanché Medical" Batteries of 60, 50, 40, or 30 cells, fitted with battery commutator, reverser, and interrupter (Silvertown pattern). "Agglomerate" cell, with agglomerate blocks attached to the carbon plate and insulated from the zinc by india-rubber bands. "Round torpedo firing" cell, with felt diaphragm and circular zinc—used for firing spar torpedoes, with safety plunger contact; the zinc plates in this battery are 14¾ inch × 4¾ inch, and the carbon electrode 7 × 4¾ inches, the latter being in a felt bag containing grain carbon and peroxide of manganese. "Ship" battery—zinc plate 35½ × 9 inches; the carbon electrode consists of four carbon plates coupled together and inclosed in a felt bag containing grain carbon and peroxide of manganese. One of these cells is said to be capable of firing a broadside of twenty-four guns. "Six rod agglomerate" cell (Silvertown pattern). This latest new form of Leclanché cell, now being made in large numbers at the Silvertown works, is deserving of special notice. The favour which the Leclanché battery has met with on account of its high electromotive force, easy management, and cleanliness has hitherto been somewhat modified owing to its want of constancy. Under the influence of the current the peroxide of manganese is reduced to the sesquioxide, causing an increase in resistance, and the evolution of ammonia in considerable quantity is an additional element in reducing its constancy. An important improvement was no doubt effected in the earlier form by employing what are known as "agglomerate" plates, which obviate the use of porous pots, thereby decreasing the internal resistance of the battery and rendering the depolarising agent more effectual. But even with this improved form, experiment shows that when working through low resistances the electromotive force of the battery rapidly diminishes, though it recovers rapidly when the latter is inactive; it is in this polarising tendency that a very material improvement has been effected by the latest form given to the cell. The positive electrode consists of a fluted carbon rod having grooves of a rather smaller diameter than that of the agglomerate rods; six of these rods surround the centre rod and are held in close contact with it by india-rubber bands, so that the small spaces between the two facilitate the circulation of the liquid and the dissipation of the gas evolved; a coarse canvas bag prevents contact between the agglomerate rods and a circular zinc. The large depolarising surface thus brought to bear on the positive electrode secures great constancy, whilst the very small internal resistance (¼ ohm for a three-pint cell) admirably adapts the battery for local circuits, firing torpedo-fuzes, &c. The highly satisfactory results obtained from this form of cell at the Silvertown Works, as well as at the Post-office (where it is employed for what is known as "The universal system," in which several parallel circuits are worked from one common battery) seem to promise for it an extended use in the future. Mr. Jeffery, the superintendent of the Falmouth office of the Direct Spanish Telegraph Company, writes:—"A battery of four of these cells has been used as a local battery since 26th March and is still (12th September) in circuit. The resistance of our local circuit is about 70 ohms. As our traffic during this period has been very good, and has of late considerably increased, the work this battery has done has been almost continuous; with the exception of being refilled with water about once a month to replace that lost by evaporation, and with being charged with fresh solution (sal ammoniac) upon two occasions, viz., July 10th, and August 28th, it has required absolutely no attention. Up to the present time, this battery has never failed to work the Morse recorder (on the local circuit) and has given me entire satisfaction. The E. M. F. was observed on 12th September, and showed a fall of about one-third." This result certainly speaks highly for the cell, for as compared with the Daniell or bichromate of potash battery, it has much greater cleanliness than either of the two, whilst at the end of six months it has a higher E. M. F. than the bichromate element could show under similar conditions.

Torpedo Apparatus.

The exhibit of torpedo apparatus is very interesting, and is as follows:—

Pair of "Telescopic firing arcs," for firing and converging stations, fitted with telescope, vernier, *sights* with platinum contacts attached, contact rod, spirit level, and levelling screws.

A "Seven shutter signalling and firing" instrument, consisting of automatic relay for switching the torpedo cable from the *signalling* to the *firing* battery, a shutter to indicate the number of the mine exploded, and bell to attract the attention of the operator.

"Mathieson's improved circuit closer"—used in connection with the *electro-contact system*—with

coiled tapering spring. When set vibrating by the concussion of a passing vessel, this instrument gives a succession of contacts, each of which completes the torpedo circuit.

"Torpedo testing table," fitted with astatic detecter, a three-coil galvanometer, key, commutator, Wheatstone bridge, set of resistance coils, and clip for holding a definite length of platinum wire.

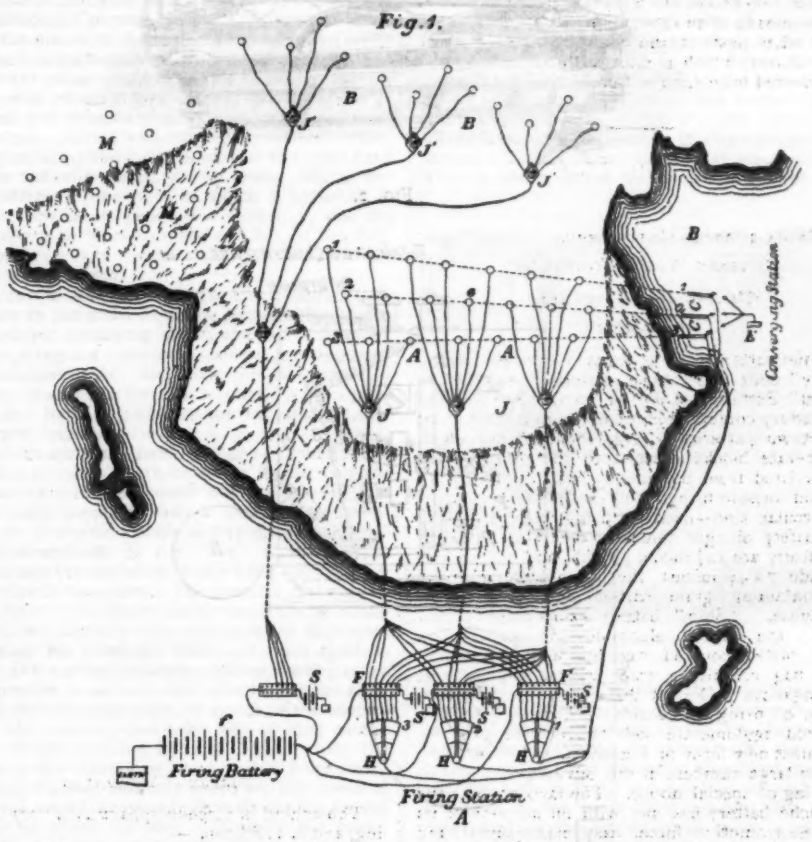
The remarkable development during the last few years in the science of submarine warfare, and the important *rôle* which it seems destined to play in the maritime wars of the future, induces us to enter somewhat fully into the existing electric torpedo systems, as it is a subject of considerable interest, and one to which the attention of many of our readers has perhaps been little directed.

Firing Torpedoes by Observation.

Fig. 1 is a sketch of an imaginary harbour, defended by submarine mines. A and B are, respectively, the *firing* and *converging* stations. The firing station is provided with the battery necessary to explode a mine, a firing arc, H, and key, a shutter *signalling and firing instrument*, F, for each group of mines, and a speaking instrument to communicate with the converging station, B. At the latter there are, in addition to the speaking apparatus, three converging arcs, C, C, and keys, one for each *line* of mines. A four-core cable connects the two stations, one conductor being required for each line of mines and the fourth (not shown in the figure) for telegraphing purposes.

There are three groups, A, A, each consisting of seven torpedoes, moored in three lines, converging, as shown, to the arcs, C, C, at station B. Single core cables connect these mines at the junction boxes,

Fig. 1.



J, J, with the three seven-core cables communicating with the firing station. To simplify the arrangement on shore, the conductors are so joined up that each *line* of mines communicates with a separate *signalling and firing apparatus* and its telescopic firing arc.

The *firing arc*, fig. 2, consists of a cast-iron frame, *x*, with levelling screws and spirit level, and is fitted with a telescope, T, capable of vertical and horizontal movements, and also of being raised and lowered by a rack and pinion motion. The

telescope is provided with cross wires, and carries a vernier, v, which follows every horizontal movement of the telescope, and traverses a graduated scale. A clamp screw is also provided to fix the telescope in any required position. On the outer arc of the frame are *sights*, *s*, with metallic V-contacts, *k*, attached to, but insulated from, the rest of the instrument. The position of these *sights* and

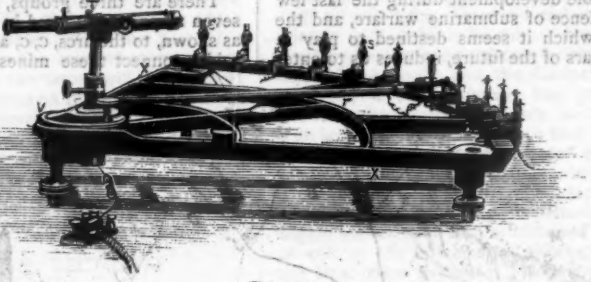


FIG. 2.

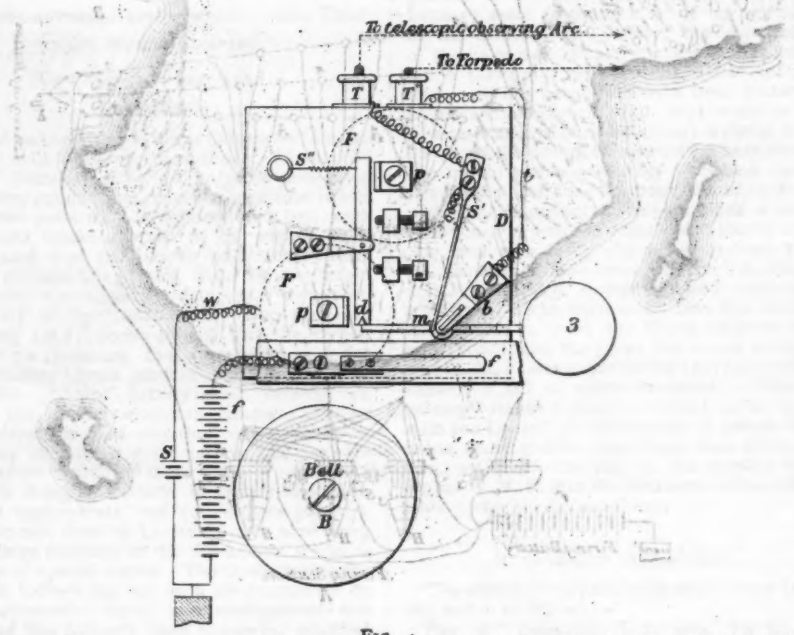


FIG. 4.

their metallic contacts on the arc are made to correspond with the bearings of their respective mines, as fixed by careful telescopic observation, when the torpedoes are first moored; each sight is, moreover, labelled, to indicate the number of the mine. Rigidly connected to the upright which carries the telescope, and moving with it, is a brass rod, *r*, at the end of which is a spring contact, which passes over and rubs against the V-contacts, corresponding to the several mines. This movable rod is insulated from the framework and put in connection, through a contact key, with the cable leading to the corresponding arc at the converging station. The *converging arc* has also a telescope, the *sight* being very carefully adjusted so that the axis of the telescope passes through its particular line of torpedoes. The operator at this station is provided with a key by which he can put the cable leading to the corresponding firing arc to earth at will.

The Shutter *Signalling and Firing Instrument*, fig. 4, is in principle an automatic relay for switching the firing battery, *f*, into circuit and showing the number of an exploded mine, so that any breach in the line of defence is indicated. In the present instance, each instrument, of which there are three,

consists of seven relays in one case, *i.e.*, one for each torpedo in one of the three converging lines of mines. Its construction is as follows: Secured to an electro-magnet, F F, is an ebonite plate, D, through which the soft iron poles, *p p*, protrude. Between these poles is the armature, pivoted at its centre, and held back, when not influenced by a current, by a light spring, *s*', and limited in its movement by screws. A detent, *d*, at the lower end of the armature, presses against the end of a pendulous lever which is pivoted near its centre in the bearings, *b*, and has at its other extremity a metallic disc, or shutter, 3. A spring, *s*' (connected with one end of the electro-magnet coils and the terminal to which one of the contacts on the telescopic observing arc is attached) presses against a platinum tongue, *m*, on the pinion of the lever, so long as the latter remains in a horizontal position. But as soon as the current passes from the weak *signalling battery*, *s* (generally of only two cells), the armature is attracted and releases the lever, when the disc, 3, falls, breaks contact with spring, *s*', attracts attention by striking the bell, B, and at the same time engages the clip-spring, f^1, in doing which the firing-battery, *f* (one pole of which is to earth), is switched into the torpedo cable circuit, T, and the mine exploded. Moreover, the number on the disc, when the lever is in a vertical position, shows which mine has been fired.

In order to bring the above action about, it is necessary to put earth on at the terminal leading to the telescopic observing arc, T, and this is done by *both* the *firing* and *converging* stations pressing their keys simultaneously; for, since the earth plate, E, is at the *converging* station, it is only by their joint action that the firing battery can be switched into the torpedo circuit.

It will be seen on referring to the connections in fig. 4, that if a *good* earth be made in the torpedo cable circuit the same result will follow. This is what actually happens when a *circuit closer* is employed in connection with a torpedo, as will presently be described.

Let us take the case of an enemy's ship approaching the first line of torpedoes. The operator at the firing arc, 1, who controls the whole advanced line of torpedoes, follows carefully the movements of the vessel by turning his telescope from one fixed sight to another, as the vessel changes position, closing at the same time the V-contact, corresponding to the sight at which the telescope rests, by means of the contact rod, *r*, and pressing down his key as long as the vessel is within striking distance. Meanwhile, the observer at the converging arc, 1, waits till the vessel is crossing his *line*, and only keeps his key down so long as the vessel is covered; directly she has passed the line he opens his key. If while the vessel crosses B's first line the operator at A cannot cover her with any of his sights, he does not close his key, because the ship is evidently passing between two torpedoes and on to the second line of mines. The same operation is then gone through between firing and converging arcs No. 2, and only when the vessel is passing over a spot where the lines of a sight on the firing and corresponding converging arc intersect each other will both keys be down and the torpedo exploded. Suppose the ship to have passed the first line and be crossing torpedo marked *e* in the second line, in order to fire that mine the operator at firing arc, 2, will have his telescope on his middle sight and his key down, while the operator at station, B, will simultaneously be pressing the key corresponding to his telescope which commands the middle line of mines. In this case the current from the signalling battery, S, passes through the coils of the signalling and firing instrument, F, to terminal, T, to contact of firing arc, 2 (corresponding to torpedo, *e*), then to conductor of cable connecting firing arc, 2, with converging arc, 2, and thence by key to earth. The result is that the armature, *p*, *p*, is attracted, and trips the lever so that the disc falls, breaks contact between the tongue, *m*, and the spring, s^1, switches in the firing battery (usually of 100 cells Leclanché), and allows the current to pass from spring, f^1, through lever of shutter, bearings, *b*, and so by torpedo terminal, T^1, to explode the mine. On referring to the figure it will be seen that so long as the lever of the signalling and firing instrument is in its normal horizontal position, the terminals, T and T^1, are virtually one, being in metallic connection through the spring, s^1, hence a circuit closer floating above the torpedo (fig. 9), and operated by the concussion of a passing vessel, performs precisely the same functions as that accomplished by the two operators on shore; in fact, the two systems, firing by *observation* or *intersection*, and what is known as the *electro-contact system*, are generally employed together, and are both entirely independent of each other. It will, of course, be at once apparent that the arrangement of the torpedo-fuze must in each system be different. In the electro-contact system platinum wire fuze is used, which has a comparatively small resistance, so that when a ship strikes the *circuit-closer* and puts earth on, the signalling battery of two cells is ample to work the signal and firing instrument; whereas, when firing by *observation* a high tension fuze or some electro-magnetic switch arrangement in connection with a separate platinum fuze is employed, with a resistance too high for the signalling battery to work through effectually, but which is readily made to fulfil its function by the heavy firing battery. The

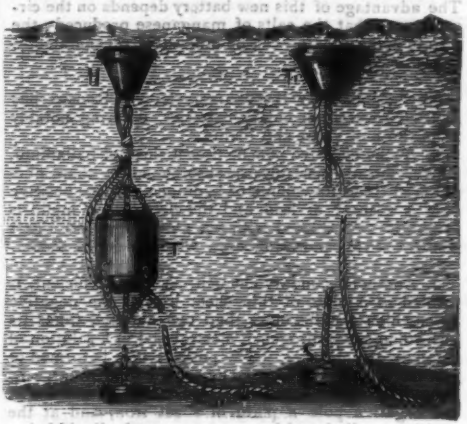


FIG. 9. FIG. 10.

electro-contact system is clearly practicable by day or night, while firing by observation is limited to clear weather; but, on the other hand, the electro-contact system, to be operative, requires that a vessel actually strike the *circuit-closer*, and taking into consideration that torpedoes have to be moored a considerable distance apart so that the bursting of one may not explode its neighbour, a breach in the line of obstruction would necessarily reduce the chance of a ship coming into collision with an electro-contact mine, whereas it might easily pass near enough, if not to be destroyed, at any rate to be disabled by torpedoes fired by observation, so that the one system is a powerful auxiliary to the other.

(*To be continued.*)

Notes.

A NEW BATTERY.—M. J. Rousse proposes to substitute ferro-manganese for the zinc in the Bunsen element. A battery thus constructed has the same electromotive energy as one with amalgamated zinc. The advantage of this new battery depends on the circumstance that the salts of manganese produced—the nitrate and sulphate—can be utilised or regenerated.—*Comptes Rendus.*

NEW SECONDARY BATTERIES.—M. J. Rousse has devised several secondary batteries, differing notably from those of Faure and Planté.

1. At the negative pole he uses a sheet of palladium, which, during electrolysis, absorbs more than nine hundred times its volume of hydrogen. At the positive pole is a sheet of lead, and the electrolysed liquid is sulphuric acid diluted with ten parts of water. This element is very powerful, even when of small dimensions.

2. Another secondary element, also very efficient, is formed of a plate of thin sheet iron at the negative pole, which absorbs more than two hundred times its own volume of hydrogen, if electrolysed in a solution of sulphate of ammonia. The positive pole is formed of a sheet of lead, which may be coated with litharge or white lead. The author has also used with success at the negative pole a plate of sheet iron, and at the positive a cylinder of ferro-manganese, the liquid being a solution of sulphate of ammonia. He lays down the general rule that to form a secondary battery it is sufficient to place at the negative pole of the voltameter a metal which has the property of absorbing hydrogen, when immersed in a suitable liquid, as at the positive pole, a metal which absorbs oxygen or peroxidises itself.—*Comptes Rendus.*

THE ELECTRICAL UNITS.—M. Dumas communicated to the French Academy of Sciences the definitions of the terms, ampère, volt, ohm, farad, and coulomb, as formally adopted at the recent Congress of Electricians.—*Comptes Rendus.*

STEEL MELTING BY ELECTRICITY.—M. Dumas also described the remarkable results of an experiment performed by M. C. W. Siemens, in the Palais de l'Industrie. Several kilos of steel were melted by the electric current in a crucible of magnesia. The fusion, effected in fourteen minutes, merely requires that an electro-dynamic machine should be set in motion at an outlay in fuel less than would have been required for direct fusion in an ordinary furnace.

TELEPHONE EXPERIMENTS IN SYDNEY.—The *Sydney Mining Herald* reports some experiments which have been made by the representatives of the Crossley Telephone Company, of London, between Melbourne and Albury, a distance of 200 miles, and between Sydney and Parramatta "with the most satisfactory result, the conversation carried on between these places being as distinct as that of two persons in the same room."

THE WHEATSTONE FAST-SPEED APPARATUS.—We understand that the Western Union Telegraph Company (America) have given an order for 12 complete sets of the Wheatstone automatic fast-speed apparatus to be sent out from England, the intention being to work the same on the company's lines. As the Wheatstone instrument does not profess to work at the extreme high speed which is claimed for more than one transatlantic apparatus, it is somewhat significant that its employment should be determined on.

THE S. S. HOOPER.—The telegraph s.s. *Hooper* has been bought by the India-Rubber, Gutta-Percha and Telegraph Works Company. The ship, which is to be renamed the *Silvertown*, is the largest cable ship afloat. Her measurements are:—Length over all, 350ft.; beam, 55ft.; moulded depth, 36ft.; gross tonnage, 4,935 tons; net register, 3,724 tons. She has three cable tanks, each 30ft. deep, and having respectively the diameters 41ft., 53ft., and 51ft., with the usual cable gear. The ship leaves England in March to assist in laying the 3,000 miles of cable now being manufactured by the company for the west coast of South America.

ON the 14th and 23rd ult. gales of unusual violence swept over the United Kingdom, doing much damage to the telegraph plant throughout the country. From reports received, it appears that the major portion of the damage to the land lines was caused by the falling on the wires of uprooted timber, and that to the submarine lines by the anchors of drifting vessels. The east coast of Scotland has perhaps suffered most in this respect; the two cables in the Firth of Forth, connecting Granton with Burnt Island, being broken, and communication between these points being completely interrupted.

THE JERSEY CABLE.—The recent interruption in the Jersey cable appears to have been caused by a somewhat unusual kind of fault. The cable parted near the shore; but instead of an "earth" fault being caused thereby, the gutta-percha closed over the broken end and sealed up the break, thus producing a "disconnection."

A MYSTERIOUS DOCUMENT.—In 1783 the French Academy of Sciences was called upon to examine an invention which seems to have anticipated in some way the electric telegraph. It was stated that by its means a message could be transmitted in a few seconds over a distance of 30 leagues without intermediate station. Condorcet, the reporter for the commission of examination, stated that the system was ingenious and practicable. In order to insure the rights of the inventor, a sealed packet containing the details was deposited with the Academy. M. Aglave has written to inquire whether this packet ought not to be searched for in the archives of the Academy, and to suggest that now that a century has almost passed since it was deposited, the rights and wishes of the inventor would not be outraged if it were to be opened. The administrative council of the Academy have been instructed to give the matter their attention.—*Mechanical World.*

THE PARIS EXHIBITION.—It has been decided that the Paris Exhibition is to close on the 17th of the present month.

THE SHETLAND CABLE.—On the evening of the 26th ult. telegraphic communication between the mainland and Shetland was restored after an interruption of upwards of six months.

UNDERGROUND TELEGRAPHS IN GERMANY.—The system of underground telegraphy devised by Dr. Stephan, Postmaster-General of Germany, is now completed. On the 14th of March 1876, the first line of cable from Berlin to Halle was commenced, and on the 26th of June, 1881, the system was completed by laying the cable from Cologne to Aix-la-Chapelle. In eighteen months eighteen lines have been laid, comprising, according to the *Algemeiner Anzeiger*, 3,394 miles of cable, costing 30,200,000 marks (£1,510,000). The 18 lines connect 221 towns, including the most important places of commerce and chief fortifications of the German Empire. The conductors in the 3,394 miles of cable have a total length of 23,213 miles. The weight of the materials consumed in manufacturing these cables was 12,825 tons, consisting of 10,165 tons of iron, 823 tons of copper, 837 tons of gutta-percha and hemp, and 383 tons of asphalte. In the crossing of rivers 70 cables were required.

DANGEROUS TELEPHONE WIRES AND UNDERGROUND LINES.—An inquest has been held in Birmingham on the body of James Trueman, who was killed by the fall of a chimney stack during the recent gale. It was stated that a wire belonging to the British and Irish Telephone and Electric Works Company was fixed to the chimney in question, and that the wire broke near to the stack. A builder was of opinion that if the wire had not broken, or if it had never been attached to the chimney, the stack would not have fallen. The jury returned a verdict of death by misadventure, but added that in their opinion it was dangerous to the public safety to fix wires to chimney stacks, that they were surprised that the Corporation allowed the wires to be so fixed without proper supervision, and that the only safe course to adopt was to carry such wires underground.

THE SOCIETY OF ARTS.—The following are among the papers announced to be read during the next session of the Society of Arts: "Telephonic Communication," by Lieut.-Col. C. E. Webber, R.E.; "The Storage of Electricity," by Prof. Sylvanus Thompson, D.Sc.; "The Distribution of Time by a System of Pneumatic Clocks," by J. A. Berly, C.E. The usual short course of juvenile lectures, given during the Christmas holidays, will be by Mr. W. H. Preece, F.R.S., the subject being "Recent Wonders of Electricity." The following papers, which indirectly bear more or less on the electric light question, will also be read: "The Production and Use of Gas for Purposes of Heating and Motive Power,' by J. Emerson Dowson; "Gas for Lighthouses," by John Wigham (illustrated by an exhibition of some of the gas flames and apparatus used in lighthouses).

THE ELECTRIC LIGHT BY TIDAL POWER.—At a recent meeting of the Bristol Town Council, a proposition was submitted to utilise the rise and fall of the tide on the Avon as a motive power in connection with illuminating the city by the electric light, but it was stated that a committee had been investigating the merits of the various systems, and that they considered it desirable to wait their further development.

JOHNSON'S CARBON TELEPHONIC TRANSMITTER.—The Preston Board of Guardians have selected Mr. Johnson's carbon transmitter for the line of telephonic communication which it is intended to establish between Fulwood workhouse and the Union offices. This instrument was tested against the Blake, and also the Gower transmitter, and found, it is stated, to be superior to both.

THE ELECTRIC LIGHT AT CHESTERFIELD.—In consequence of the success of the experiments made in lighting the streets of Chesterfield by the electric light, the Watch and Lighting Committee have made an arrangement for the lighting of the town for one year for a sum less than that paid per year to the gas company by a considerable amount.

THE ELECTRIC LIGHT IN CANADA.—The engineer of Ottawa has reported against the proposal to light the city by electricity. The present cost of doing so by gas is stated to be £2,546. Electricity generated by steam would cost £4,960, and, if water power were utilised, £3,200.

THE ELECTRIC LIGHT IN TURKISH LIGHTHOUSES.—The Turkish Government is at present studying the question of electric lighting of the lighthouses along Turkish coasts. A Frenchman, M. Michel, has been charged with the erection of the new lighthouses projected on the shores of the Red Sea. An international commission has met at Constantinople to fix the tariff of those lighthouses, which are greatly required for navigation.

INFLUENCE OF ELECTRICITY ON THE GROWTH OF THE VINE.—M. Macagno, in *Les Mondes*, states that he has been making experiments on the influence of electricity upon the growth of the vine. An electric circuit was formed by copper wire between the extremity of a branch bearing fruit and its origin near the soil. More wood was formed in the branch, which contained less potash than the other parts, and the grapes ripened more readily, containing an excess of sugar.

THE SOCIETY OF TELEGRAPH ENGINEERS AND OF ELECTRICIANS.—At the first meeting of the session, commencing on Thursday, November 10th, Mr. John Alexander Lund will read a paper on the system of synchronising clocks adopted in London and elsewhere, with an exhibit of a complete set of all the various instruments connected with its working.

ANOTHER APPLICATION OF ELECTRICITY.—The newspapers mention that "what is supposed to be an infernal machine of rude construction has been found on the roof of the Masonic Hall at Dingwall. It is inclosed in a small wooden box, and contains a roughly modelled electric apparatus and a quantity of dynamite or other explosive substance. It has apparently been constructed by some person acquainted with electricity.

ELECTRIC COMMUNICATION WITH LIGHTHOUSES.—The Lord Mayor, M.P., has received the following letter from the Prime Minister:—"10, Downing Street, Whitehall, Oct. 31.—My Lord Mayor,—I have had the honour to receive from you a copy of resolutions passed by a meeting held at the Mansion House with respect to telegraphic communication between lighthouses and lightships and the shore, and have at once forwarded them for consideration to the Board of Trade.—I have the honour to be, my Lord Mayor, your most faithful and obedient servant, W. E. Gladstone."

TELEPHONIC.—Threatening notices having been sent by the United Telephone Company to the subscribers to the Plymouth Exchange, counter-action has been commenced by Mr. Pope Cox, the proprietor, who lays his damages at (we hear) £10,000. In reference to this matter the Post Master General advertises that he has at present licensed no other exchange than that worked by Mr. Cox.

THE Lancashire and Cheshire Telephone Company (provincial branch of the United Company of London) has purchased the business of Messrs. Moseley and Sons of Manchester, and, we are informed, has appointed Mr. Moseley manager. (Another sale effected!)

THERE is in course of formation, amongst those interested in telephonic inventions other than Bell's or Edison's, a syndicate for mutual defence in "Telephone Infringement" law-suits. Something of this kind was attempted some time ago, but so long as the United Company can find the money wherewith to buy, unity in defence amongst those who are *indifferent* whether their money is made alone or in company (so long as it is made) is almost an impossibility. Most men will take what they considers their price and—clear out.

New Patents—1881.

4654. "Lighting by gas and electricity combined." R. H. COURTENAY. Dated October 25.

4664. "Electrometers." J. IMRAY. (Communicated by J. C. Carpentier.) Dated October 25.

4670. "Improvements in metallic pillar posts and columns for telegraphic and other purposes and in the machinery employed to produce the same." R. B. LEE. Dated October 25.

4694. "Apparatus for actuating signalling apparatus on railways by means of electricity." E. EDWARDS. (Communicated by E. Lesbos.) Dated October 27.

4695. "Method and means for utilising electric-circuits for various purposes, such as telephonic and telegraphic communication, controlling or synchronising time measures, fire or burglar alarm systems, and the like." W. F. BARNETT. Dated October 27.

4748. "Galvanic or electric batteries." W. R. LAKE. (Communicated by J. F. Aymonnet.) Dated October 29.

4758. "Apparatus for the transmission of vocal and other sounds." F. J. SMITH. Dated October 31.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1881.

768. "Connecting the carbon ends to conducting wires in electric lamps." E. G. BREWER. (A communication from abroad by Thomas Alva Edison.) Dated Feb. 23. 6d. Consists in uniting the carbon to the wires in any suitable manner, and then electroplating the point of union, thereby making permanent the union and at the same time making perfect electrical contact between the carbon and the conductors.

879. "Electric light signalling." ARTHUR SHIPPEY. Dated March 1. 4d. Relates to improvements in electric light signalling, chiefly applicable for use at sea, for the purpose of assisting in the saving of life, also for signalling for military and other purposes. A balloon or kite has suspended from it an apparatus provided with an electric light lamp. When it is required to give a signal the balloon or kite is allowed to ascend to the required height, which may be regulated by the quantity of cord or wire unwound from a windless. The wire or cord is then connected with the battery or other generator of electricity so as to produce an electric light in the lamp.

894. "Electric lamps." J. J. SACHS. Dated March 2. 6d. Relates to improvements in electric lamps. The two carbons are placed in tubes arranged side by side, either vertically or at an angle, with the bottoms of the carbons resting upon a plate or upon the side of a body of a globular or other suitable shape, such plate or body being composed of asbestos, porcelain, or other suitable material. At the point of contact of the carbons with the plate or body, the latter may be perforated so as to admit of the emission of the light whilst preventing the carbons from passing through. As the carbons wear, they descend by gravitation, assisted if necessary by a weight or spring, and are thus always maintained in contact with the plate or body so as to insure constancy and uniformity in the light.

918. "Producing audible signals on railways by electricity." E. TYER. Dated March 3. 8d. Relates to means for giving audible signals which may serve in lieu of the usual signals when these are obscured, or which may be employed along with the visible signals as additional means of securing the driver's attention. For this purpose at the distant signal, or preferably at some distance in advance of it, a gong or bell is mounted, having its hammer worked by the armature of an electro-magnet, the coil of which is intermittently excited by electrical currents transmitted from a battery. These electrical currents are intermitted by means of a rotating commutator caused to revolve by clockwork, which clockwork is kept wound up so as to be ready to start when required; for the purpose of starting it, an electrical contact apparatus is arranged at the side of the rail at a point some distance in advance of the gong or bell, so that on a train passing this point it, by depressing a trigger or by causing deflection of a rail, effects the required contact.

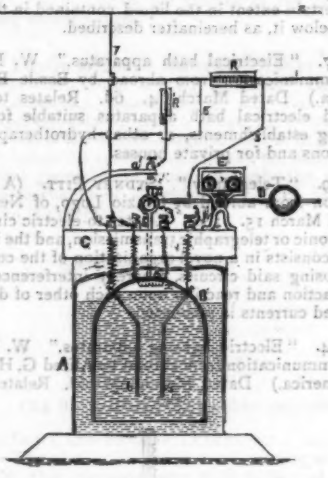
925. "Telephone transmitters." C. MOSELY. Dated March 4. 6d. Relates to the construction of apparatus for transmitting sound by the aid of electricity, and having for their object the reduction in the amount of electrical resistance in the transmitter and the attainment of an increased intensity of sound in the receiving instrument, and consist in the employment of precipitated sulphide of copper in a loose form or consolidated by pressure.

977. "Electric and automatic signalling apparatus." ERNEST DE PASS. (A communication from abroad by Hippolyte Leblanc and Eugène Victor Achille Loiseau, both of Paris.) Dated March 8. 6d. Consists in the combination of various apparatus, which together serve as a novel means for electric and automatic signalling for operating the signal discs on railways, and especially those discs on Leblanc's system.

991. "Galvanic batteries." GEORGE F. REDFERN. (A communication from abroad by Siegfried Marcus, of Vienna.) Dated March 8. 6d. Relates to improvements in galvanic batteries, equally applicable for military as for domestic purposes. The improvements also relate to the general arrangement of the parts forming the battery, particularly to the construction and employment of what may be termed a permanent element, and of a device whereby the usual earthenware porous pots now generally employed are not required. (*Provisional only.*)

1016. "Veber-meters." E. G. BREWER. (A communication from abroad by Thomas Elva Edison.) Dated March 9. 6d. Relates to apparatus for measuring an electric current. One part of the invention for this purpose consists in deflecting a definite proportional part of the current to be measured and

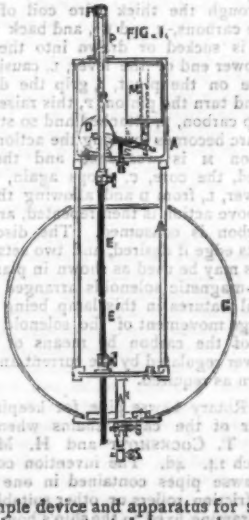
passing it through a vessel partially filled with water and floating in the same liquid. The water in the vessel is decomposed by the current, and the gases formed displace a portion of the water in the vessel, lessening its specific gravity and causing it to rise. The rising of the vessel causes the lifting of a lever connected with a registering mechanism, so that the amount of gases produced being proportional to the current passing through the vessel, and this in turn proportional to the main current, the last may be indicated by the register. Such arrangement is made that when a definite predetermined amount of decomposition has taken place the vessel will rise to a sufficient height to close an electrical circuit, which will send a current through the gases and explode them, so that they will be re-composed into water and the vessel again fall. These operations being repeated so long as current passes. Figure 1 is a view of an apparatus for this purpose; A is a tank of water, and B a vessel also containing water floating therin; 1, 2, is the main circuit from which, by means of the resistance placed



at R, a definite portion of the current is deflected into the circuit, 5, 6. This circuit passes through the water in the vessel, B, and returns again to the main circuit. 7, 8, is a third circuit from the main one, and is broken at the contact points, a, a^1. C is the top of the tank, A. It supports a suitable registering apparatus, E, and the contact a^1, and the wires of the circuit, 5, 6, and 7, 8, passes through it. Also passing through C is the projection, b, which extends up from the vessel, B, operating the lever, D, of the registering apparatus, and terminating in the contact point, a. As above stated, in consequence of the resistance, R, a definite portion of the current is deflected from the main current into the wire, 5, and passes down through C into the vessel, B. The lower portion of this current, 5, 6, is completed by the water, and the current in passing through it decomposes a portion thereof, which rises in a gaseous form to the surface. As the upper portion of the vessel becomes filled with these gases, the specific gravity of the whole is lessened and the vessel rises, carrying with it the projection, b, and thus moving the lever, D, which operates the register. When the upper part of the vessel, B, is entirely filled with the gases it rises to such a height that the contact, a, will meet a^1, and close the circuit, 7, 8. A current of electricity immediately passes along this circuit heating the platinum coil, x, and causing by explosion the re-composition of the gases into water. The vessel, B, then falls to its former position, re-opening the circuit 7, 8, and the current again passes through the circuit, 5, 6. This operation is of course continually repeated. A resistance placed at R^1 prevents the passage of too large a current of electricity through the circuit, 7, 8. Another portion of this invention consists in an arrangement for measuring an electric current as follows:—An electric depositing cell has a metal lining which forms one of the electrodes thereof, being connected in any suitable manner with one of the leading wires. The other electrode is a piece of metal suspended within the cell by a spring, the stress of the spring being so adjusted that the metal piece will be sustained at the top of the cell when there is a minimum of deposition thereon, while the maximum of deposition will cause it to sink to the bottom. An index arm is attached to the metal piece and a scale provided in connection therewith, so that the amount of deposition will be visually indicated. The electrodes are also connected with a registering apparatus and circuit reversers which change the direction of the current through the cell, and consequently reverse the anode and the cathode, so the metal is first deposited on and then removed from the metal piece, causing it to rise and fall, so that the registering apparatus works whenever the circuit is reversed.

1027. "Electric lamps." J. A. BERLY. Dated March 10. 4d. Consists in hinging the movable electrode in the Jamin lamp by means of a spring instead of a pivot. (*Provisional only.*)

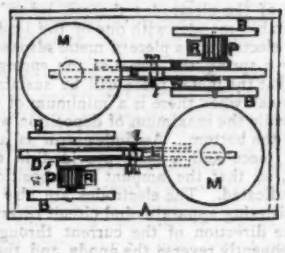
1040. "Electric lamps." A. A. COMMON and H. F. JOEL. Dated March 10. 6d. Relates to certain improvements in electric light arc lamps or regulators, and also to improvements in the construction of incandescent electric light lamps. The improvements in electric light arc lamps or regulators consists essen-



tially of a simple device and apparatus for striking and controlling the arc actuated by a solenoid, also of various devices for feeding and regulating the length of arc. Figure 1 shows a sectional elevation of a complete lamp, and figure 2 a plan of same. In the box or

frame, A, is mounted on bearings, B, a pinion, P, and large disc or wheel, D; into the pinion, P, is geared the rack, R, to which rack top electrode, E, is attached; on the other end of the rack, R, is a piston head, P, which almost fits into a cylinder, P^1, the said cylinder, P^1, being filled with glycerine or other fluid. As the rack, R, falls the glycerine must pass through the orifices

FIG. 2.



shown by dotted lines in P, and so retard and regulate the fall of R. On the axis of P are attached two weighted arms, W, between which arms a gripping lever, L, is pivotted at *l*; the said arms, W, rest upon the adjustable support, S. On the other side of the box is an electro-magnet solenoid coil, M, one part or section being wound with thick wire in the main circuit, the other part being wound with fine wire of suitable resistance and in reverse direction to the thick wire and connected to shunt across the arc as is well understood. In the centre of this coil is an iron core, C, he bottom end of this core, C, being connected loosely to the end of gripping lever, L. At the bottom of the lamp is shown the globe, G, the lower electrode E^1, the rames, A^2, A^3, A^4, and the globe holder, G^1, with an arrangement, *g*, g^1, for lowering the globe. The action of this lamp is as follows:—When an electric current is sent through the thick wire coil of M, it passes through the carbons, E and E^1, and back to its source, the core, C, is sucked or drawn into the coil, M, and raises the lower end of the lever, L, causing the other end to move on the pivot, *l*, grip the disc D, at the point, l^1, and turn the pinion, P, this raises the rack, R, with the top carbon, E, attached and so strikes the arc. When the arc becomes too long the action of the thick wire coil on M is weakened and the shunt coil strengthened, the core, C, drops again, releasing the gripping lever, L, from D and allowing the rack, R, to fall; the above action is then repeated, and so on until all the carbon is consumed. The disc, D, may be milled on its edge if desired, and two sets of gear with two carbons may be used as shown in plan, figure 2, or two electro-magnetic solenoids arranged side by side, the essential features in this lamp being the transferring the large movement of the solenoid core to a fine movement of the carbon by means of the disc and gripping lever regulated by the current and feeding the carbon down as required.

1087. "Rotary hawse pipe for keeping submarine cables clear of the cable chains when the ship is swinging." T. COCKSHOTT and H. M. GOODMAN. Dated March 14. 4d. The invention consists of two rotating hawse pipes contained in one casting, and carried on friction rollers or other suitable bearings in flanges or framing fixed to the ship's bow. The hawse pipes consist of a larger and smaller one, the larger being concentric with the rotating casting and intended for the ship's cable, and the smaller one at one side, their axes being parallel. The revolving casting is rotated by means of a lever or levers inserted in one or other of a series of mortices on its periphery, or by spur or bevel gear or other suitable mechanical means.

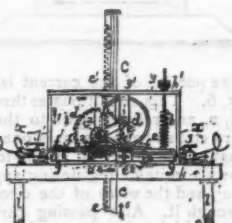
1094. "Automatic rapid telegraphy." B. J. B. MILLS. (A communication from abroad by W. A. Leggo, of Hartsdale, America.) Dated March 14. 8d. The object of this invention is to furnish a system of automatic rapid telegraphic transmission in which one machine may be used both for the preparation for transmission, and for the transmission of messages.

1097. "Voltaic batteries, &c." J. H. JOHNSON. (A communication from abroad by La Société Anonyme la Force et la Lumière Société Générale d'Electricité, of Paris.) Dated March 14. 6d. Relates to electric or voltaic batteries, and it consists in the employment in the construction of the said batteries of vessels or receivers made narrow at the lower part and wide at the upper part, the said vessels being filled with a suitable liquid and superposed in any desired number and arranged in such a manner that each vessel is immersed to a certain extent in the liquid contained in the vessel next below it, as hereinafter described.

1107. "Electrical bath apparatus." W. R. LAKE. (A communication from abroad by Basile Barda, of Vienna.) Dated March 14. 6d. Relates to an improved electrical bath apparatus suitable for public bathing establishments, or other hydrotherapeutic institutions and for private houses.

1119. "Telegraphy." SYDNEY PITT. (A communication from abroad by Orazio Lugo, of New York.) Dated March 15. 10d. Relates to electric circuits for telephonic or telegraphic transmission, and the improvement consists in a novel organisation of the conductor-composing said circuits, whereby interference arising from action and reaction upon each other of derived or induced currents is prevented.

1384. "Electric lighting apparatus." W. R. LAKE. (A communication from abroad by Alfred G. Holcombe, of America.) Dated March 29. 6d. Relates to improvements in electric lighting apparatus. Figure 1 is a side elevation partly in section of an electric lighting



apparatus, in which the current is divided to actuate independent feeding and arc-forming devices. The electric current from the generator is divided at *j*, and passes through two independent circuits, 1 and 2. The circuit, 2, includes the two parallel flat coils, f^2 and f^3, and is always closed; and the other circuit, 1, includes the solenoids, m, m^1, and the carbons, a, a^1, and is closed only when the carbons are in contact, or when the arc is produced between their ends. The whole of the current first passes through the two flat coils, f^2 and f^3, thus instantly releasing the brake wheel, e, and allowing the rod, c, and carbon, a, to fall until arrested by the carbon, a^1; the circuit, including the solenoids, m, m^1, and the carbons, a, a^1, is thereby closed, and the greater part of the current passes through it, as its resistance is much less than that of the circuit, 2. The solenoid, m^1, is now attracted within the solenoid, m, against the action of the spring, n, drawing the carbon, a^1, with it from the carbon, a, and forms the electric arc between the ends of the carbons. The upper carbon, a, is now held up by the brake devices, e, e^1, as the spring, h, is adjusted to oppose the mutual attraction of the flat coils, f^2, and f^3, due to the amount of the current now passing through them.

2943. "Electro-magnetic motors." SYDNEY PITT. (A communication from abroad by Moses Gerrish Farmer, of America.) Dated July 5. 6d. Relates to certain improvements in electro magnetic motors, in which the ends of an electro-magnetic coil or helix are united just before the connection between the helix and the electrical generator is broken, whereby the spark due to the discharge of the extra or induced current from the coil is prevented.

City Notes.

Old Broad Street, November 3rd, 1881.

THE WEST INDIA AND PANAMA TELEGRAPH COMPANY, LIMITED.—The ninth ordinary general meeting of the members of this company was held to-day at the Cannon-street Hotel. The report of the directors, sets forth the accounts for the six months ending 30th June, 1881. The amount to credit of revenue is £41,303 4s. 1d., which includes £1,535 16s., interest received from underwriters in respect of insurance on the s.s. *Investigator*. The expenses have amounted to £29,366 12s. 8d., leaving £11,936 11s. 5d., which, with the balance of 1,956 5s. 9d. from last half-year's account, makes a total of £13,892 17s. 2d., out of which it is proposed to make a payment of 3s. per share on account of arrears of dividend on the first preference shares, amounting to £5,184 9s., and to carry the balance to current half-year's account. The traffic receipts for the half-year are practically the same as those for the corresponding period, the revenue of both periods having been affected by interruptions. All the stations of the company are now telegraphically connected, and the only cables interrupted are the original Jamaica-Santiago and Jamaica-San Juan sections, which are duplicated. These cables are in course of repair. The directors, from the experience they have gradually obtained, have had in contemplation the deviation of those sections of cable which have frequently failed over the same ground. Most of the necessary soundings to ascertain if safer routes could be selected have been completed by H.M.S. *Fantome*, and the company's s.s. *Duchess of Marlborough*. One of the most important of the deviations proposed, viz., that of the St. Thomas-St.-Kitts cable, was carried out by the company's s.s. *Grappler* in September last, with an expenditure of about 65 knots of cable. The whole of the detailed reports of soundings have not yet been received, but there is reason to hope that safer routes can in some cases be found, and that the effect of the deviations will be to reduce the chances of interruption. Three hundred knots of cable have been ordered, which will be ready for despatch to the West Indies in January next. The 7 per cent. debentures of the company, amounting to £10,200, became due on 1st May last. £4,400 of these were renewed at 6 per cent., the remainder have been retired, and £26,600 debentures have been issued on the terms stated in the circular of 25th June last, making the total issue of debentures to date £35,000 at 6 per cent. per annum. The directors proposed that Mr. Grosvenor should visit the West Indies again this autumn to continue the negotiations for increase of subsidies, and to endeavour to secure unanimity in the decisions of the Governments; but the prevalence of yellow fever in many of the colonies, and the quarantine regulations arising therefrom, interposed obstacles to travelling from island to island and necessitated the postponement of Mr. Grosvenor's visit. The negotiations have, however, been continued by letter, and it is understood that the Secretary of State for the colonies has communicated with the several Governments, recommending a conference of delegates to consider the telegraph question. Application for a subsidy has also been made to the Government of France, and is under the consideration of the Ministry. Mr. C. W. Earle, the chairman, said that, compared with the gloomy period 18 months ago, their position had improved, for they were able to pay their preference shareholders a dividend. There was, he was glad to say, no interruption in communications; but he was sorry to say, on the other hand, that some of the colonies had refused subsidies. With respect to France, it was proposed to lay before the Assembly a proposition to pay the company a subsidy of £4,000 a year. There was no doubt that the colonies were anxious for direct lines to this country. The ships of the company had been well employed, and had only been in harbour for the time necessary for repairs. The first duty was to maintain the lines, and if that was done public feeling in the West Indies would improve in their favour. Since the issue of the report the directors had placed the remaining £50,000 to debentures. He moved the adoption of the report. A discussion followed at the close of which the report was adopted.

BRAZILIAN SUBMARINE TELEGRAPH COMPANY, LIMITED.—The sixteenth half-yearly ordinary meeting of the shareholders in the above company was held October 28th at the City Terminus Hotel, under the presidency of Viscount Monck (the chairman of the company). The report of the directors for the half year showed that the revenue amounted to £86,017, the working expenses to £12,710, leaving a balance of £73,307, to which was added £34,310, the undivided profits to 31st December last, making a total of £107,617. After deducting income tax £1,107, there remained a balance of £106,510. A third interim dividend, amounting to £19,500, had been distributed, leaving the sum of £87,000, for appropriation. The directors now declared a final dividend of 3s. per share, making a total of 6 per cent. for the year, and the payment of a bonus of 2s., which together would amount to £32,500, being a distribution in the aggregate of 7 per cent. for the year, leaving a balance of £54,510,

of which £50,000 had been added to the reserve fund, increasing that fund to £345,349, leaving £4,510 to be carried forward. The chairman, in moving the adoption of the report and statement of accounts, said he would trouble the shareholders with but very few remarks on the present occasion, for the simple reason that he had a very short story to tell. Referring to the table at the bottom of the report showing the receipts every year since the cable commenced operations, he thought the facts there disclosed were, to say the least, not unsatisfactory—(hear, hear). Beginning with the receipts of the year 1874-5 of £128,000, they kept creeping gradually up every year until they amounted to £167,000 in the present year. He did not think that could be otherwise than satisfactory to the shareholders. It showed the sound and gradual increase in the receipts of the cable, and that was combined with a gradual increase in what they had often had some discussion about in that room, viz., the reserve fund, which now stood at the present price of the investments in their ledger. That, of course, included the £50,000 which it was proposed to put in the reserve fund for the past year. There was another subject in connection with the receipts which was also satisfactory, and that was that the gradual increase in the receipts and reserve fund had been accompanied by a gradual contemporaneous increase in the net receipts of the shareholders. Last year they paid a dividend of 6 per cent.; this year they declared 7 per cent. As soon as the board were satisfied that they could give them—not 7 but 20 per cent.—consistently with the maintenance of their concern, they would give them every shilling they earned, but they considered it was absolutely necessary to lay up in order to secure the permanence of their dividend. Turning to the other side of the account, he said the expenditure for the past half-year, as compared with the previous half-year, showed an increase of £967. That increase was exclusively confined to the stations out of London. The general expenses in London showed a decrease of £59. The increase in the out stations was brought about by certain special payments, which must recur after certain periods of time, but which did not recur every year. That was due to the fact that they had spent £454 for new furniture, and they had paid a sum of money to the Brazilian Government for the importation of those articles into the Brazils. There had also been a new Government tax imposed at Pernambuco and Lisbon, which accounted for about £120 more. Turning from the accounts, he paid a brief tribute of respect to the memory of his late colleague, Mr. W. H. Clark. There was one other point, standing there as he did as the representative of their managing body, upon which he ought to touch. He alluded to the fact that a diminution of the insulation had taken place in one of the three sections in which their cable was divided, as follows:—From Lisbon to Madeira, from Madeira to St. Vincent and Cape de Verde, and from St. Vincent to Pernambuco. The cable, however, was working perfectly well; it was carrying all the messages they wanted, but there was undoubtedly this depreciation in the insulation. Experiments had been made, tests had been applied, with the result that the flaw had been localised and calculated to exist somewhere about 30 miles from Pernambuco, in water of not more than 14 or 15 fathoms. The repair of the cable was as certain as if it were lying on the floor of that room, but it was a mere question of time and expense. They had sent out directions to work the cable as long as it would hold, and in the meantime they were doing there business and taking their receipts just as they did before. Having assured them that there was not the least cause for alarm, he concluded by moving the adoption of the report, which was seconded by Sir James Anderson (vice-chairman), and upon being put to the meeting was declared unanimously carried. The dividend was then declared, and Sir Thomas Fairbairn, bart., having been duly elected a director of the company, a shareholder rose and put several questions. The chairman, in reply, having reminded the hon. proprietor that his remarks were out of order, said with regard to the three sections it was quite plain that any one of these sections might give out, but the other two would remain in full working order. He declined to answer the next question, which had reference to the reserve fund. They had the exclusive right of carrying messages to the Brazils for nearly twelve years more. The usual compliment to the chairman, directors and officers of the company brought the meeting to a close.

EDISON GOWER BELL TELEPHONE COMPANY OF EUROPE.—We are informed that a new company (with a capital of £500,000) for working the telephone in most of the principal countries of Europe has been registered under the above title, with Colonel Gouraud as chairman.

INDO-EUROPEAN TELEGRAPH COMPANY.—Direct communication with India by the Indo-European line is at present interrupted from this country owing to the breakage of the submarine cable between England and Germany. The line is, however, working as usual in connection with the Continent of Europe.

The following are the final quotations of stocks and shares for Nov. 3rd.:—Anglo-American, Limited, 52½-53; Ditto, Preferred, 81½-82½; Ditto, Deferred, 23½-24; Brazilian Submarine, Limited, 11½-11¾; Brush Light, £4 paid, 7¾-8¼; Ditto, £10 paid, 16-17; Electric Light, 1-1¼; Consolidated Telephone Construction, ⅞-1⅛; Cuba, Limited, 9½-10; Cuba, Limited, 10 per cent. Preference, 16-17; Direct Spanish Limited, 5-5½; Direct Spanish, 10 per cent. Preference, 14½-15½; Direct United States Cable, Limited, 1877, 10¾-11; Debentures, 1884, 100-103; Eastern Limited, 10-10½; Eastern 6 per cent. Preference, 13-13½; Eastern, 6 per cent. Debentures, repayable October, 1883, 100-103; Eastern 5 per cent. Debentures, repayable August, 1887, 100-103; Eastern, 5 per cent., repayable Aug., 1899, 105-108; Eastern Extension, Australasian and China, Limited, 11-11¼; Eastern Extension, 6 per cent. Debenture, repayable February, 1891, 108-111; 5 per cent. Australian Gov. Subsidy Deb. Scrip, 1900, 102-105; Ditto, registered, repayable 1900, 102-105; Ditto, 5 per cent. Debenture, 1890, 99-102; Eastern and South African, Limited, 5 per cent. Mortgage Debentures, redeemable 1900, 102-105; Ditto, ditto, to bearer, 102-105; German Union Telegraph and Trust, 10½-10¾; Globe Telegraph and Trust, Limited, 6¼-6½; Globe, 6 per cent. Preference, 12¼-12½; Great Northern, 11¾-12¼; 5 per cent. Debentures, 103-106; India Rubber Company, 24-25; Ditto, 6 per cent. Debenture, 104-105; Indo-European, Limited, 27½-28½; London Platino-Brazilian, Limited, 4¾-5; Mediterranean Extension, Limited, 2½-3; Mediterranean Extension, 8 per cent. Preference, 9½-10; Oriental Telephone, ¼-½; Reuter's Limited, 12-12½; Submarine, 290-300; Submarine Scrip, 2¼-2½; Submarine Cables Trust, 97-100; United Telephone, ——; West Coast of America, Limited, 4¾-4¾; West India and Panama, Limited, 1¾-2; Ditto, 6 per cent. First Preference, 7½-8; Ditto, ditto, Second Preference, 6¼-6½; Western and Brazilian, Limited, 6¾-7¼; Ditto, 6 per cent. Debentures "A," 110-115; Ditto, ditto, ditto, "B," 98-102; Western Union of U. S. 7 per cent., 1 Mortgage (Building) Bonds, 123-128; Ditto, 6 per cent. Sterling Bonds, 104-107; Telegraph Construction and Maintenance, Limited, 26½-27½; Ditto, 6 per cent. Bonds, 104-108; Ditto, Second Bonus Trust Certificates, 1¼-1¾.